THE

ENCYCLOPÆDIA

EDINENSIS.

ENCYCLOPÆDIA EDINENSIS:

OR

DICTIONARY

OF

ARTS, SCIENCES, AND LITERATURE.

IN SIX VOLUMES,

INCLUDING ALL THE MODERN IMPROVEMENTS TO THE PRESENT TIME; AND ILLUSTRATED WITH UPWARDS OF ONE HUNDRED AND EIGHTY ENGRAVINGS.

KNOWLEDGE IS POWER.—BACON.

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ENCYCLOPÆDIA EDINENSIS.

Brechin.

BRECHIN, a borough town in Angus-shire, in Scotland, which is finely situated on the declivity of the northern bank of the river Southesk, and is eight miles west from Montrose harbour, from whence the tide approaches it within two miles. It consists of one large and several smaller streets, and the population in 1811 was stated at 5559. The manufacture of Osnaburghs and sail-cloth, and the spinning of flax by machinery, with an extensive brewery for beer and porter, which produced 20,000 barrels annually, for home consumpt and exportation, furnish the chief employment to the inhabitants.

Brechin was founded by David I. about the year 1150, and it was a rich bishopric before the reformation. The cathedral, a Gothic structure, supported by twelve pillars, is in part ruinous, occasioned by the ungovernable rage of the reformers, and part of it serves as the parish church, being commodiously fitted up for that purpose; it has an elegant steeple, 120 feet high, in the form of a square tower, with battlements on the top. Contiguous to this stands a remarkable round tower, which is an object of attention to strangers. It is 103 feet high, consisting of 60 regular courses of hewn stone, placed in a circular manner, and tapering towards the top, and surmounted by an octagonal spire. It is furnished with four windows facing the cardinal points, and other four in the spire placed alternately on the sides, and resting on the top of the tower. Near the bottom are two arches, one within the other; on the top of the outermost is seen a crucifixion; between the mouldings of the outermost and inner, a figure of the Virgin Mary and of St John; and on each corner of the bottom of the arch, figures of certain beasts; the whole is finished with exquisite workmanship. Antiquaries have been at a loss to determine the original design for which this kind of tower, of which there is only another in Scotland, at Abernethy, has been constructed.

Of the old castle of Brechin, which was situated on the south side of the town, no trace remains; it stood a desperate siege in 1303, but was compelled to surrender to the English under Edward III. when the brave governor, Sir Thomas Maule, was slain by a stone thrown from an engine. A noble mansion is now built on the site of the castle, belonging to the family of Panmure.

In 1647 this town was greatly distressed by the plague, which carried off 600 inhabitants in the course of one month.

Brecknockshire || Breda.

BRECKNOCKSHIRE, or BRECON, a county of South Wales, having for its boundaries Radnor, Cardigan, and Caermarthen on the north and west, Hereford, Monmouth, and Glamorgan shires on the east and south; is about 35 miles in length and 30 in breadth, and includes a superficial extent of more than 500,000 acres, of which nearly one half is under culture. This county presents great variety of romantic scenery in its lofty mountains, rich vales, and extensive woods. The principal rivers are the Usk, the Wye, and the Yrvon, the picturesque and sublime beauties of whose banks, particularly of the Wye, have often enlivened the descriptions of the tourist. Brecknock Beacon, supposed to be the loftiest mountain in South Wales, is in this county. A lake, about two miles from the town of Brecknock, is two miles long, and nearly of the same breadth, and abounds with otters, tench, perch, and eels.

The population of this county, which in 1801 was estimated at 31,633, had increased, in 1811, to 34,750. It is divided into six hundreds, and 62 parishes. Beside those employed in the labours of agriculture, many of the inhabitants are occupied in the manufacture of woollen stuffs and stockings. The remains of pavements, and of a bath near the town of Brecknock, shew that it was once occupied by the Romans.

BRECKNOCK, or BRECON, the capital of the county of the same name in South Wales, stands on a romantic spot at the confluence of the rivers Hondey and Usk. The ruins of strong towers, of religious houses, and of walls with which it was surrounded, indicate its antiquity and former importance; and fortifications, pillars, bricks, and the occasional discovery of coins in the town and vicinity, afford ample proof of its occupation by the Romans. A tower of the ancient castle is employed as an armoury, and contains 15,000 stand of arms. The population, in 1801, amounted to 2576, and had increased, in 1811, to 3196. Woollen cloths and cotton stockings are the only manufactures. Brecon is 168 miles distant from London.

BREDA, the capital of Dutch Brabant, stands in a marshy country, at the junction of the rivers

Aa and Merck; is strongly fortified, and surrounded with a wall and ditch; and the neighbouring territory can be flooded with water to prevent the approach of a hostile army. The city is of a triangular form; a gate built of brick is erected at each angle, and the ramparts are adorned with rows of elm-trees. The principal buildings are the castle, a large square edifice; the great church, a noble structure, remarkable for its fine spire of 362 feet in height; and the mausoleum of Engelbert Count Nassau, which is enriched with inscriptions and statues. The population is estimated at 10,000; and the manufacture of woollen stuffs, in times undisturbed by the calamities of war, with which Breda has been often visited, has prospered.

Breda was the scene of a severe struggle between Spain and the United Provinces in the 16th century. Reduced in 1567 by the duke of Alva, it was delivered up ten years afterwards to the States-General; and in 1590 was regained by Prince Maurice, who found means to introduce sixty Dutch soldiers, concealed under the cargo of a small vessel, and by them he was admitted into the place during the night. But the most memorable siege happened in 1625, when it was invested by the Spanish general, Spinola, by an army of 50,000 men, and defended by a small garrison of 7000 infantry and a few troops of cavalry, composed of French, Dutch, and English; and after a blockade of ten months, in which the besiegers and besieged sustained all the calamities of disease and famine, and lost about two-thirds of their number, surrendered on very honourable and advantageous terms; and the feeble remains of the garrison were treated with great kindness and generosity on account of their bravery. It was recovered in 1637 by Henry prince of Orange, after a siege of four months; and in 1667, Breda was the seat of the famous conference between the commissioners of France, England, Denmark, and Holland, which terminated in a general peace, and hence called *the peace of Breda*. The calamities of war again visited Breda in the time of the French revolution, and during that eventful period it acknowledged the authority of different masters. Breda is twenty-two miles S.E. from Rotterdam, and forty-six miles south from Amsterdam.

BREMEN, the capital of a duchy of the same name in Germany, and subject to the king of Great Britain as elector of Brunswick, stands on the banks of the Weser, and is divided by that river into two parts, which are denominated the old and the new town, between which a commodious communication is established by means of several bridges. On one of the bridges machinery is erected to raise water for the supply of the town. The town-hall, loaded with a profusion of ornaments, the exchange a modern edifice, the arsenal, the college, and the Lutheran church, are the chief buildings. The houses are well built, and the streets are spacious and clean, excepting in the old town, where they are narrow, and the buildings are in a more antiquated and less commodious form. Bremen is furnished with several philosophical and literary institutions; and the observatory is under the direction of the celebrated astronomer Olbers, the discoverer of the planets Pallas and Vesta.

The population is stated at 40,000; and various kinds of cloth, as linen, Osnaburghs, and printed calicoes, stockings, glass, starch, and strong-beer, for which last Bremen has been long famous, employ the industry and ingenuity of the inhabitants. The whale and salmon fishery are also successfully prosecuted; the trade in wines with France is considerable; the exports in iron, flax, and linen to England, Spain, and Portugal, are extensive; and the commercial intercourse with America is important. Bremen is 48 miles from Zell, and the same distance from Hamburgh.

BRENTFORD, a market-town of Middlesex in England, stands on the north bank of the Thames, is traversed by the river Brent, from which it derives its name, and is famous as the place of election for the members of parliament for the county, when an unusual concourse of persons from the metropolis are drawn to this busy and interesting scene. The population is about 2000; and malting, distilling, brick-making, and the manufacture of earthenware, give employment to many of the inhabitants. To the eastward of Brentford, and on the opposite side of the Thames, are the royal palace and splendid gardens of Kew; and at no great distance to the westward is Sion-house, formerly a rich and celebrated nunnery, and one of the first which was suppressed by Henry VIII. and now the princely residence of the duke of Northumberland. Brentford is seven miles west from London.

BRENTWOOD, or BURNTWOOD, a town of Essex in England, stands on an elevated situation on the road from London to Colchester and Harwich, includes about a thousand inhabitants, and is 18 miles from London.

BRESCIA, an ancient city of Italy, is situated at the foot of a range of mountains on the river Garza, in a plain beautified with verdure, and watered by numerous streams; it is about a league in circumference, surrounded by walls, and defended by a castle. The streets are elegant, and there are several squares, one of which is surrounded with piazzas, and has the town-house in the centre. Nineteen parish churches, thirty convents, a general hospital, a lyceum, some charitable houses, a palace of justice, which is a most splendid edifice, and a cathedral, are its principal buildings.

The population is about 42,000, and the inhabitants, who are very ingenious and industrious, are employed in the manufacture of pistol and musket-barrels, swords, knives, &c. and the working of iron-mines in the vicinity. Copper, jasper, alabaster, touchstones, and a stone which resists fire, of which they form vessels, are found in the vallies and suburbs, and converted into use. They likewise make millstones of different kinds, and have a process of manufacturing lintseed and grape-stone oil. The fisheries are valuable; and gold, as well as fish, is found in the rivers Adige and Oglio. The trade in linen and woollen cloth, in silk, flax, cheese, and iron, is extensive and lucrative.

The territories of Brescia are fertile and abundant in pasturage, so that a crop of flax or millet is not unfrequently raised after one of wheat in the same year.

The cows, from whose milk a large proportion of the celebrated Parmesan cheese is made by the inhabitants around Lodi, are fed in the Brescian territories during the winter season. A sweet wine, called *santo*, which is of a rich yellow colour, is made in the vicinity of Brescia. The distance of Brescia from Mantua is 32 miles, and from Milan 44 miles.

BRESLAU, one of the largest cities of Germany, and capital of Prussian Silesia, is situated on the south side of the Oder, and occupies an extent of two German miles. It contains many commodious streets, and several squares, the houses of which are about five stories high. Of the public edifices, the churches, the hotel de Ville, the college of the Jesuits, the academy, the exchange, the customhouse, the bishop's palace, and a monument erected to General Count Tauenzien, the governor, who commanded during the siege of 1760, the botanical garden, an anatomical theatre, two armouries, a mint, and several libraries, are the principal; and the walks and gardens in the neighbourhood are enumerated among the beauties of the place.

The population is said to exceed 60,000, of which many are French, Bohemians, and other foreigners, and a vast number of Jews. The principal manufactures are iron wares, broad cloths, and other woollen stuffs, silk stuffs, paper, gunpowder, needles, hats, stockings, leather, and calicoes. Besides there are numerous tanners, dyers, and furriers, to whom the Ohlau affords water to facilitate their operations.

Breslau is the centre of the trade of Silesia, has commercial intercourse with Hamburgh through the canal, and with the north of Germany and the Baltic; and exports chiefly the linens of Silesia, flax, thread, wool, fine cloths, and madder.

The imports from the other parts of Germany, from Spain, Italy, and Holland, consist of the various productions of those countries, which are consumed in the town or the surrounding territory.

The land in the neighbourhood is level, and, excepting near the rivers, affords excellent corn; its pastures are rich, abounding with sheep and cattle, and the cows are of a large size. Breslau is 35 German miles from Berlin, 44 from Leipsic, and 74 from Hamburgh.

BREST, a sea-port town in the department of Finisterre in France, situated on a hill on the north of the bay of that name, is divided into two parts, the Cote du Brest and the Cote de Recouvrance, which communicate by boats; and has two parish churches, a governor, a board of admiralty, and a marine seminary. It is chiefly remarkable for its famous road and harbour, capable of containing 500 ships of war in good anchorage, and its barracks, magazines, rope and sail-cloth manufactories, extensive arsenal, dock-yard, forges, and foundery. The entrance to the harbour, which is narrow, is guarded by a castle next the sea, and the town is defended by a ditch and fortifications on the land side.

The population of Brest is 26,000; the trade in wines and brandy, and the fishery, are considerable; and two fairs are annually kept, where cattle, skins, and various merchandise are sold. Brest is 125 leagues distant from Paris.

BRETON, Cape, an island lying near the east coast of North America, between 45° and 47° north latitude, and 50° and 60° west longitude from London, which is separated from Nova Scotia by a small passage called the Gut of Causo, about 100 miles in length and six in breadth, and having the appearance of a cluster of islands. It was discovered about the year 1500 by the Normans and Bretons, and is improperly called Cape Breton, having been supposed to be a part of the continent. The French possessed themselves of it in 1713, and erected Fort Dauphin, which they abandoned from the harbour being of difficult access, and built Fort Louisbourg at an immense expence, where the harbour affords good anchorage.

The climate is cold, and the soil marshy; yet, on the south of the island, abundance of corn, hemp, and flax are cultivated. The inhabitants have chiefly devoted their attention to the fishery, which, while the French possessed the island, was worth a million sterling.

In 1745 the British attacked this island with the assistance of 6000 American troops, and succeeded in procuring a surrender. By the treaty of Aix-la-Chapelle it was restored to the French; but was reattacked in 1758. The French made a vigorous resistance; and having sustained severe loss, several of their ships and frigates being destroyed, were obliged to yield to the intrepid valour of the besiegers. It was confirmed to Great Britain in 1763, since which time the fortifications of Louisbourg have been destroyed.

The possession of Cape Breton is of great value to Great Britain, by securing the fisheries on its coasts from intruders; by the mines of iron and coal, which may be easily wrought to advantage; and by its forests of good hard timber.

BRETAGNE, or Britany, a large province of France, which, in the new division of that kingdom since the revolution, forms several departments. It is bounded on the north, west, and south by the sea, and on the east by Maine and Anjou; enjoys a temperate climate, and possesses great variety of soil. Some parts of it are clothed with woods; excellent crops of wheat, hemp, and flax are raised; and the more elevated districts afford good pasture to numerous herds of cattle. Fruits are abundant; cyder, it is said, is the common drink of the inhabitants; game and fish are plentiful. Mines of iron, lead, and coal have been wrought; and the natives of the sea-coast have been long famous as skilful and hardy seamen.

BREWING.

Introduction.

BREWING is usually defined the art of making malt liquors; but as these liquors differ from wines in little more than the nature of the materials from which they are prepared, the term may not improperly be extended to include the making of all vinous or fermented liquors; and in this sense it is employed in the present Treatise, in which it is proposed to exhibit the principles and describe the practice, according to the most approved methods, of making ale, beer, porter, mead, cyder, perry, and wines, generally so called. As the principal object of the Treatise is to instruct private individuals and families in these operations, and assist them in judging of the quality of fermented liquors, what may be called the domestic economy of the art will receive particular attention, and full directions will be given for preparing those liquors which habit has rendered so necessary to the comfort of a family; while brewing, as practised in the large way, will be considered in a more general manner.

History.—The history of making fermented liquors is of very great antiquity. We know that Noah understood the preparation of wine from the juice of the grape; and if we are to agree with some mythologists, that Osiris king of Egypt is the same personage with Mizraim the grandson of Noah, and to credit Herodotus, who affirms, that the art of making beer was practised by Isis the wife of Osiris, we may conclude that the origin of brewing *malt liquors* is nearly coeval with the deluge. It is certain, that both wine and beer were known among the Greeks and Romans; and that the Romans were acquainted with ale as well as wine, is evident from the writings of Dioscorides, Galen, and Pliny. Both these nations were distinguished for the variety and quality of their wines,—the *chian* of the former and *falernian* of the latter being particularly celebrated by the ancient poets. It does not, indeed, appear, that much wine was made in Italy till a late period of the Roman empire; and their mode of preparing wine seems to have been rude and simple, though the liquor produced must sometimes have been very strong, as we find it occasionally kept to a much greater age than in modern times.

The vine seems to have been introduced by the Romans both into Gaul and Britain. We find that France was famous for its vineyards in the reign of Vespasian; and it appears from Doomsday-book, that wine was made in England from native grapes at a period anterior to the conquest. How early malt liquors were known in this country is not certain; but, among the ancient Germans, beer was a very common beverage, and seems to have been usually made from malted barley. Cyder, perry, and other factitious wines, are probably of later origin, though the two former are by some supposed to have been introduced into this island by the Romans.

History.

Britain has long been celebrated for its malt-liquors; and in no country have these liquors been carried so nearly to a state of perfection. It appears that some hundred years ago, a sweet ale, brewed probably from malt alone, was in use; but after the introduction of hops from the Netherlands, in the beginning of the sixteenth century, beer brewed from malt and hops became very common. In Queen Anne's reign, it was usual to drink ale and beer mixed together; but soon after, when the brewing of hopped beer was improved, this became a favourite beverage, under the name of *entire butt*, or *porter*. This latter appellation is said to be derived from its being in general use among labouring porters. It is not a little extraordinary, that, soon after hops were generally employed in brewing, an act of parliament was passed prohibiting their use as deleterious to the health; and we are not certain that this act has ever been formally repealed, unless we are to consider the acts lately passed prohibiting the use of other bitters in place of hops as a virtual repeal of it. For a long time the brewing of porter was confined entirely to London; and it was even supposed that it could not be prepared from any water but that of the Thames; but it is now some years since this exclusive privilege has been denied to Thames water, and porter of very good quality is now brewed both in Scotland and Ireland.

Previous to the reign of Charles I. no duty had been levied on malt. This tax was first introduced during the civil war between the king and parliament, and, though at first very moderate, appears to have been extremely unpopular. During the revolutionary war from 1802 till 1815 this tax was extremely productive, having been raised to 4s. 4d. per bushel on English malt, and about 3s. 6d. on Scotch. In consequence of these high duties successful attempts have been made to economise the processes of brewing, especially by introducing the use of raw, or unmalted grain, which, were it not opposed by government, would occasion a considerable saving both of time and money to the brewer. These duties have however contributed to improve our knowledge of the chemical phenomena of brewing, by giving rise to a set of experiments on the comparative properties of different kinds of malt, which took place some years ago at Edinburgh, and were conducted by Drs. Hope, Coventry, and Thomson.

The gross amount of the duties on malt in the year 1813 was, for England L.4,188,450, 6s. 9d. and for Scotland L.134,106, 12s. and it appears that the quantity of malt made in Great Britain during that year exceeded 2,500,000 English quarters; during the following year the quantity of malt made amounted to nearly 3,000,000 quarters. Now, though a considerable portion of this malt is consumed in the distilleries, yet as the distillers now employ at least two-thirds of raw grain, the increased consumption of malt shews that a greater quantity of malt liquor is drunk now than formerly.

It appears, indeed, from Excise reports and tables of the respective London breweries, that the quantity of malt liquors made in this country has of late considerably increased. The quantity of porter made by the principal porter brewers in London had, in nine years, viz. from 1807 to 1815, increased nearly one half. In the year 1812 the quantity of porter brewed by the principal porter brewers in London amounted to 1,491,170 barrels, and the quantity of strong ale brewed by the seven principal houses in London, from July 1814 to July 1815, exceeded 107,000 barrels. The enormous price of foreign wines since the commencement of the revolutionary war, has also rendered the manufacture of made wines an object of considerable importance, and, from the attention lately paid to that subject, and the encouragement it has received from several public bodies, the quality of these wines is now greatly improved. The art of brewing malt liquors has been materially benefited by the improved application of chemistry to the processes, and especially by the introduction of the thermometer and saccharometer, to be afterwards described.

To complete this sketch of the history of brewing, it remains only to notice some of the principal British works on the subject. One of the earliest, and, on the whole, one of the best practical treatises with which we are acquainted is Michael Combrune's *Theory and Practice of Brewing*. The author was a practical brewer, and his directions for the various processes of brewing are in general very judicious; but when he attempts to theorise on these operations he is unintelligible to modern readers, from employing the antiquated chemistry of Boerhaave. It is not a little surprising that, in the new edition of this work, published in 1804, no pains have been taken, even by notes or appendix, to new-model the theoretical part of the work.

In 1784, Mr Richardson of Hull, also a practical brewer, published his *Theoretic Hints on Brewing Malt Liquors*, and *Statical Estimates of the Materials of Brewing, shewing the use of the saccharometer*, works which evince considerable knowledge and ingenuity, but are rendered nearly useless by the mysterious manner in which they are written. In 1802, Alexander Morrice, who styles himself common brewer, published his *Treatise on Brewing*, the introductory part of which contains some useful observations; but when he descends to the particular receipts for making the various ales and beers, he exhibits such a farrago of abominable ingredients, as, if they are really employed by the brewers, must disgust and terrify those who are compelled to purchase and drink the medicated potion. Doctor Shannon, a medical gentleman, who appears to have had numerous opportunities of examining the processes of brewing, and has certainly collected many valuable observations on the manufacture of almost all fermented liquors, published the result of his enquiries in 1805, in a ponderous quarto volume, intitled, "*A Practical Treatise on Brewing, Distilling, and Rectification.*" We cannot but allow to this author the palm of merit for labour and ingenuity; but his work has many and important defects. It consists of several independant books, with a voluminous appendix; and the matter of each, though often very good in itself, is so ill arranged and digested, as to render the perusal of it a heavy and laborious task, while the language in which it is composed is often inaccurate, and not seldom obscure. His proposed improvements in the processes are also difficult, if not impracticable, and the work is rendered much less useful than it might otherwise prove, by the want of an index. The latest work we have seen on the subject of brewing malt liquors, is a thin octavo, of about 140 loosely printed pages, entitled "*The Brewers' Guide,*" published in 1812, by George Lloyd Worthington, and charged at the extraordinary price of five guineas. This work contains a few valuable directions for brewing ales and porter, but they are mixed with a great deal of nonsensical theory and affectation of science.

On the subject of home made wines, under which we include also cyder, perry, and mead, there are but few respectable writers. Besides Dr Shannon's book, which contains a good deal on this subject, some valuable hints by Dr M'Culloch, for the improvement of these wines, may be found in the "*Transactions of the Horticultural Society of Edinburgh.*" They were also published in a separate treatise.

PART I. PRINCIPLES OF BREWING.

The principles of brewing comprehend an account of the various materials employed in the art, and of the process of fermentation, to which these are subjected.

Materials employed.—In considering the materials employed in the preparation of fermented liquors, it will be useful to exhibit a general arrangement of these liquors according to the substances that form their bases, though it will not be necessary to enumerate all their varieties.

I. Malt Liquors.—1. *Ale.* Table Beer, Small Beer.—2. *Porter*, Porter Beer.—3. *Ram-jam.*

II. Fermented Liquors made from Sugars, commonly called Beers.—1. *Treacle Beer*, Spruce Beer.—2. *Ginger Beer.*—3. *Black Beer.*

III. Wines made from, 1*st*, the juice of the grape.—*Red Wines.*—Tokay; Burgundy; Lachryma Christi; Red Port; Claret; Hermitage; Tent.

White Wines.—Champagne; Madeira; Teneriffe; Malmsey; Sherry; White Port; Lisbon; Vidonia; Constantia; Hock; Cape; Rhenish; Mountain; Calcavello; Frontignac; British Grape.

2*d*, Other Fruits.—Currant Red; Do. White; Do. Black; Gooseberry, ripe; Do. unripe; Cherry; Damson; Elder-berry; Orange; Lemon; Raspberry; Strawberry; Quince; Apple, (cyder;) Pear, (perry;) Raisin.

3*d*, Sugar chiefly.—Ginger; Cowslip; Clarey; Elder-flower; Baum; Palm; Birch; Parsnip; Honey, (mead.)

It thus appears that the principal substances which constitute the basis of fermented liquors are malted grain, the saccharine juices of fruits and plants, oney, and sugar, as prepared from the sugar-cane. The other ingredients, as hops, liquorice, spruce, spices, or odoriferous plants, are added to insure the preservation of the liquor, to give it some agreeable flavour, or to counteract some unpleasant property.

Of grain used in brewing.—The processes of the distiller have shewn that a fermented liquor may be prepared from any species of grain or farinaceous seed. Barley, wheat, oats, rye, rice, Indian and Guinea corn, pease, beans, have all at different times, and in different countries, been employed for this purpose; but experience has proved that barley is best adapted to the purpose of brewing ale and beer. Of this grain there are two principal species; the one, more particularly called *barley*, having the grains of the spike disposed in two distinct rows, and the undivided grains larger, specifically heavier, and more mealy; the other, known in this country by the name of *bear*, or *bigg*, of which there are two varieties, one having the spike divided into four rows, the other having it divided apparently into six, with the grains of each proportionally smaller, lighter, and thinner. The average weight of a Winchester bushel of barley is estimated at about 50 lbs. Avoirdupois, while the average weight of the same measure of bigg is scarcely 48 lbs. The cuticle or husk of barley bears a less proportion to the mealy part than that of bigg, but in other respects the composition of these grains is nearly the same. By the chemical analysis of 3840 parts of barley, there have been obtained 44 parts of albumen, 200 of saccharine matter, 176 of mucilage, 135 of gluten, 2580 of starch, 360 of gaseous products, 260 of husk, (consisting chiefly of siliceous earth and gluten,) and about six of phosphate of lime.

Malt.—Although raw grain may be employed for making fermented liquors, it is found most advantageous to convert the grain into malt. By this process, which is merely causing the grain to vegetate, and stopping the vegetation when it has reached a certain degree, the texture of the mealy part is rendered looser, and this part becomes more diffusible in water, while the saccharine principle is more completely evolved. In the process of malting there are reckoned four stages; *steeping*, *couching*, *flooring*, and *kiln-drying*.

1*st*, *Steeping* is performed by putting a certain quantity of water into a square cistern, lined with stone or lead, called the *steep*, which is situated at one extremity of the malt-barn, and usually sunk in the earth, and then throwing in such a quantity of barley as to be completely immersed in the water. The barley is then stirred and levelled, and left to steep for a period not less than forty hours, and which is generally from 50 to about 120 hours, according to the season and the kind of grain. Thus bigg requires a shorter time for steeping than barley, and in cold weather the grain requires a longer steeping than in hot weather, to produce the same effect. While in the steep, the grain undergoes several changes. By imbibing a quantity of water it is increased in bulk and weight, while part of its outer surface is dissolved in the water. Hence it is customary, though not absolutely necessary, to change the water at least once during steeping. Some air, which proves to be carbonic acid or fixed air, is extricated, and the grain when dried is found to have lost part of its weight.

2*d*, After the grain has been sufficiently steeped, it is removed from the cistern and spread upon the floor, so as to form a square heap, a foot or sixteen inches thick. It is now said to be in *couch*, and remains in this situation for about twenty-six hours. During this time the grain becomes hotter, and a moisture appears upon its surface, whence it is said to sweat; but it does not in general begin to sprout except in the middle.

3*d*, When the grain has remained thus long at rest, it is spread out upon the floor in a thinner body; and as the heat now considerably increases, it is repeatedly turned over and spread thinner for about a fortnight. During this time the incipient vegetation that had commenced in the couch proceeds. Little roots grow out at one end of the grain, and the rudiments of a stem called *acrospire*, arise from the same extremity, and push towards the other end between the husk and kernel, till they grow nearly two inches long. In the mean time the kernel becomes dryer, whiter, and acquires a sweet taste. The great object of the maltster is to conduct the process to this stage, and there to check it. This is done by exposing the malt successively to fresh cool air, so as to prevent the temperature from rising too high, while at the same time the moisture is partially dissipated, so as to prevent the overgrowth of the *acrospire*. Of course the hotter the season, and the greater the quantity of malt, the more frequently must it be turned over and the thinner it must be spread. It appears that during this process a slight degree of fermentation takes place, and a quantity of vinous spirit is produced. The time during which malt lies on the floor varies with the kind of grain, and with the different modes according to which the maltster conducts the process. In general, it lies from eight to twelve days. The flooring should cease when the *acrospire* has reached the distant extremity of the grain, as when it grows too long the quantity of saccharine matter in the malt is diminished.

4*th*, In order completely to check the progress of vegetation and arrest the malt in its most perfect state, it is exposed to a considerable heat, so as speedily to dissipate the superabundant moisture. With this view it is removed to the *malt-kiln*, which is a building composed of two floors. In the lowermost floor is kindled a fire of coak or charcoal. Above this, at a sufficient height, is extended a floor of hair-cloth, wire-cloth, or earthen or metallic plates pierced full of small holes; but hair-cloth or wire-cloth is generally preferred. Upon this the malt is spread to a thickness of from three to six inches; and the fire, which is at first very moderate, is gradually increased till the heat rises to such a temperature as experience has shewn to be the most proper for producing the kind of malt required. This temperature varies from 140° to about 186°. During the continuance of the heat, the malt is repeatedly turned, and spread, so as to expose every part as equally as possible; and when it appears to be sufficiently dry, the fire is damped, and the malt suffered gradually to cool. While cooling, however, it is trampled on and turned over to break off the radicles, or *cummings* as they are called, as at this time they are more brittle than afterwards. When the malt is quite cool, it is removed, and subjected to an operation called *cleansing*, to separate the *cummings*. This is usually done by means of *fanners*, producing such a current of air as to blow off the cummings, which are the lighter parts of the malt; and when this is completed, the malt is stored, ready for the market. By the process of malting, the grain is diminished in weight by about one-fifth; but it is generally increased in bulk. It appears, that the better the quality of the grain, the more it is increased in bulk. Thus, 100 bushels of English barley will average 105 bushels of malt; while inferior barley, or *bigg*, is often diminished in bulk, 100 bushels of *grain* not producing more than 99 of malt.

Change induced.—Here it may be proper to explain a little more at large the nature of the change which grain undergoes during the process of malting. It has been already stated, that the kernel of barley contains a large quantity of starch, together with some gluten and mucilage; but, in the raw grain, these constituents are cemented together into a hard coherent mass. Now, after malting, the starch becomes loose and friable, and a considerable part of the glutinous and mucilaginous matters has disappeared, having been consumed, as some suppose, in the formation of the roots. This starch, too, which in the raw state seems not very soluble in water, has its solubility increased by malting. It is estimated that malted barley loses about half its weight by infusion in hot water.

Varieties of malt.—According to the different degrees of heat to which the grain has been exposed in malting, or, rather, according to the manner in which the heat has been applied, malt is distinguished into three varieties, denominated, from the colour of their infusions, *pale*, *amber*, and *brown*.

It was formerly supposed, that these varieties were uniformly produced by increased degrees of temperature, the pale malt being produced by the lowest, and the brown by the highest degrees of temperature. Accordingly, Mr Combrune has given a table, in which he marks the colour which the malt acquires at various degrees of heat, from 119° to 176°; from which it would appear, that malt dried at the first of these heats is white, at 138° amber, at 148° brown, and at 176° black. Now it appears from later experience, that malt may be exposed to a heat very gradually increased to 175° and still retain its pale colour, while, if the heat be suddenly applied, though it should not reach nearly so high a temperature, the surface will become brown, or even charred.

As custom has rendered it necessary for brewers to employ malt of different colours, or substitute some colouring matter to give their liquors their proper shade, the maltster must regulate his heat accordingly. At the same time it must be remarked, that in proportion as the malt is more highly dried, especially if it assume a dark colour, in the same proportion is its real strength diminished. So well are the brewers of the present day convinced of this, that they now generally employ a greater proportion of pale malt, and colour their liquor artificially, so as to suit the taste of the public.

Test of malt.—It is of the utmost consequence to the consumer of malt to be able to distinguish good malt from bad. In acquiring this talent, however, much depends upon experience; and we are not sure that any great reliance is to be placed on the rules laid down by practical brewers for this purpose. One of these tells us, that the best way he knows "is to chew some of it in your mouth, and if you find it sweet and mellow, has a round body, breaks soft, is full of flour all its length, smells well, and has a thin skin, *then* it is good. If it is hard and steely, and retains something of a *barley nature*, it has not been rightly made, and will weigh heavier than that which has been properly malted." It is more difficult to judge of the quality of the high dried than of that of the pale malts; and, indeed, the most certain way of judging is by the *saccharometer*, as will be afterwards explained.

Malt is best preserved by piling it in heaps in a close dry loft; in which situation it will keep well for upwards of a year. Dampness injures it much, both as it renders the grain less mealy, and exposes it to the attacks of weevils.

Hops.—The principal constituents of hops are a bitter principle, capable of being dissolved in water, and a fragrant essential oil, diffusible in water, but not extremely volatile. They are of various qualities, according to the soil in which they are produced, and the manner in which they are preserved. Three kinds are in most repute, Kent, Worcestershire, and North Clay, of which the first are considered most suitable for the making of porter, and the second for the finer ales. The hops should be gathered before they have hung so long as to acquire a brown colour; and after being dried, which is usually done in a kiln, they should be put up in close bags, and well packed. They are afterwards stowed away in a dry close loft, the bags being packed close together to keep out the air and moisture.

New hops, that is, those which have been kept for about four months, are preferable to those which have been kept for a twelvemonth. In judging of them, attention is to be paid to the colour, smell, and feel. They should be of a bright yellowish-brown colour, and a fragrant smell, and, without being damp, should have a soft and oily feel.

The use of hops in brewing is partly to give an agreeable bitter to malt liquors, and partly to check their too great propensity to fermentation, and thus preserve the liquor from becoming sour. For these purposes, they are boiled with the infusion of malt for a longer or shorter time, according to circumstances which will be hereafter noticed. It has been proposed, instead of boiling the hops in substance, to make a strong extract, by gently boiling, or rather macerating the hops in a quantity of water sufficient to cover them, and mixing this extract with the wort at a proper temperature. From the long maceration which would be necessary to form such an extract, we are not sure that it would be any considerable improvement in the process of brewing.

Substitutes for hops.—From the high price to which hops occasionally rise, it has been proposed to substitute in their place various other bitters and narcotics. As the hop is not what is termed a *simple* bitter, but possesses properties similar to opium, it is not easy to find a substitute that by itself shall answer all the purposes of hops. Opium itself, therefore, and the berry called *cocculus indicus*, have sometimes been combined with the simple bitters of *quassia* or *gentian*. Probably neither of these bitters is more unwholesome than the hop, though their taste is certainly much less agreeable. We do not apprehend any great danger from the use of opium; but the *cocculus indicus* is a poisonous berry, whose use ought to be proscribed by the utmost rigour of the law; and we cannot with-hold our astonishment at seeing this drug recommended as an ingredient in malt liquors by one of the latest writers on practical brewing, who has been already mentioned in the historical introduction.

Wort.—An infusion of malt constitutes the liquor called *wort*, or *sweet-wort*, the properties of which must now be examined. Wort is a transparent fluid, whose colour is more or less intense according to the colour of the malt from which it is made. It has a luscious sweet taste, and contains a considerable quantity of sugar, in proportion, of course, to the quantity of malt, and the time of infusing. The wort first drawn off, therefore, is the strongest, and each succeeding infusion proportionally weaker.—Besides sugar, there is found in wort a quantity of mucilage, some starch, and some gluten, or albumen, which last separates when the wort is boiled. From its holding these matters in solution, wort is, of course, of considerable density. The mode of estimating this will be explained hereafter.

Fermentable juices.—In considering the nature and composition of those fermentable juices of fruits from which wines are made, it will be proper to class them according to their qualities. In the enumeration at page 5. the *juice of the grape* occupies the foremost rank, as being that from which alone good wine is made without any admixture. The component parts of the juice are pretty much the same, in point of number, in all the numerous varieties of grapes, though they differ in proportion, according to the climate and cultivation. It contains a considerable quantity of *sugar*, especially in those grapes that are the produce of a warm climate. To the sugar it owes its richness; and those grapes which are most highly ripened produce in general the fullest-bodied wines, as the *Muscadine*, *Tokay*, *Frontignac*, and *Black Cluster*. It also contains two or three vegetable acids, as the *tartaric* in combination with potash, the *gallic*, and probably the *citric*. From these it derives its sharpness and astringency, though this latter depends more on the husk of the grape, and is particularly sensible in the red grapes, especially the *claret*. A peculiar *colouring matter*, apparently of a resinous nature, is combined with these principles, and is also most conspicuous in the red grapes, in which, except in the claret, it resides chiefly in the husk. A little *mucilage*, and a peculiar *aromatic* principle, probably an essential oil, are the only other ingredients that require to be noticed here. To this last the grapes owe their peculiar flavour, which is most remarkable in the white and red *Frontignac*, the white *Muscat* of Alexandria, and the Tokay. Much of this, however, is lost in fermentation; and wines generally receive their flavour, as well as colour, from some artificial addition.

In the *raisin*, or dried grape, few of the constituents of the recent juice remain, except sugar and mucilage, with a little astringency, chiefly in the stalks. We have, therefore, placed it as a connecting link between the fruits and sugar.

The juice of *currants* nearly resembles that of grapes, except that it contains little or no tartaric acid, and its saccharine principle is in a less concentrated state; hence probably, like the juice of most of our northern fruits, it is more disposed to run into the acetous fermentation. *Gooseberries* contain *citric* and *malic* acids, the former of which is the chief constituent in *oranges* and *lemons*, and the latter in *apples*, *pears*, and *quinces*. The *malic* acid is more abundant in unripe than in ripe gooseberries; hence the wine made from this fruit is different, according to its state of maturity. The juice of the *elder-berry* is somewhat like that of the currant, but contains more colouring matter and less acid. It is sometimes employed to heighten the colour of other wines. *Cherries* and *damsons* contain less juice than those fruits we have already mentioned; that of cherries is the sweetest, that of damsons the most austere. The raspberry and strawberry are remarkable for little, but the juice of the former has a peculiar rich flavour, much of which it retains in the wine. All these fruits, however, except apples and pears, require the addition of sugar in brewing wine from them.

Sugar.—Sugar alone is capable of making a vinous liquor, and is undoubtedly the principal fermentable ingredient in the must from which all these liquors are produced, though it be variously modified by the admixture of other bodies. Sugar is employed as the basis of vinous liquors under several forms: 1*st*, *Pure*, as derived from the juice of the sugar-cane, in which state it is used in making all the wines in the third division of the arrangement, except *mead*: 2*d*, In the state of *molasses*, or *treacle*, under which form it is used for making a kind of table-beer, generally called *treacle-beer*, and in the preparation of *spruce-beer*, and we believe it not unfrequently forms the basis of those domestic wines which are to have a deep colour: 3*d*, In the state of honey, which, as has been already noticed under Bee, Vol. I. p. 604, is merely a saccharine juice that has undergone an animal change; this is used chiefly in the making of mead, but is also prepared to be employed in the brewing of made wines: And, 4*thly*, as it exists in the juice of some plants, as the *palm*, the *birch*, and the *parsnip*, from each of which a good wine may be produced. There is another saccharine juice that is sometimes employed in brewing porter and high-coloured ales, which, though of a coarser quality, partakes much of the nature of the 4th order of sugars, namely the juice of *liquorice-root*, either as expressed from the fresh root, or in its inspissated state, called *Spanish liquorice*, or *black-sugar*. Both of these are heavy sugars, but where colour is wanted it may be a very innocent addition.

The odoriferous and aromatic substances of baum, clarey, elder-flowers, cowslip, and ginger, are merely added to a saccharine vinous liquor to give it a peculiar flavour or pungency.

Spruce.—The young tops of the *spruce-fir* were long ago employed, either infused or boiled in wort, for impregnating ale with diuretic and antiscorbutic qualities, and the liquor thus formed was much used

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at sea, under the name of *spruce-beer*. Of late an extract, or *essence*, of spruce has been prepared, and sold in stone bottles; and this essence is added to wort, or must, as will be hereafter directed.

Water.—Among the substances employed in brewing, one so necessary as *water* must not be passed unnoticed, though brewers do not at present attach such importance to its qualities as formerly. In the old works on brewing, a great deal is said on the chemical properties of this fluid, and it was generally supposed that the purest water was the best adapted to the purposes of brewing, as being lightest and most wholesome. River water was preferred to well water, and Mr Combrune has given a long table of the comparative properties of Thames, New-river, and Hampstead water, those formerly used in London. Of late, however, it has been found that the substratum of the soil on which London is built abounds with springs of excellent water, and every brewery is now provided from this ample source with wells whose water answers all the purposes of the establishment. Some modern brewers still maintain that soft water is best suited to the making of porter, and hard-water for ales. In general, any spring-water that is not too hard, and has no unpleasant mineral impregnation will make very good liquor; but rain-water, as being often muddy and abounding in corrupt vegetable matter, should be avoided, as, independent of the impurities it contains, it is said to accelerate fermentation and dispose to acidity. The quality of water may be sufficiently ascertained for the purposes of brewing, by the usual criterions of its transparency, insipidity, want of smell, and its forming a smooth lather with soap. If it be desired to have a surer analysis, it may be obtained by having recourse to the tests to be afterwards noticed in another place.

Fermentation.—To explain the phenomena and nature of fermentation, by which such important changes are produced on *must*, we shall take one of the simplest examples, by supposing a vinous liquor to be formed from sugar and water set to ferment. Let three pounds of powdered lump sugar be dissolved in a gallon of spring water, simmering it over the fire, and removing the scum as it rises. Set the clear liquor by to cool till it acquires the temperature of 60° of Fahrenheit's thermometer, and then put into it a piece of toasted bread, having both sides covered with yeast. The solution of sugar is *must*, as all liquors capable of being, by fermentation, converted into wine, are called; it is transparent, has a mild sweet taste, is specifically heavier than water, has in it little or no air, and does not sparkle when poured into a vessel. When this liquor has stood for some time after the yeast has been added to it, keeping up the temperature as near to 60° as possible, the following appearances take place: The transparent liquor gradually becomes turbid, and particles of air are seen forming in it and rising to the surface, where by degrees they form a coherent scum, which, if the quantity of must be considerable, assumes an irregular surface and considerable thickness, an intestine motion is evidently going on in the liquor, and the temperature increases. After these appearances have continued for a time, longer or shorter according to circumstances, the intestine motion diminishes, the scum becomes flatter, and, if not removed, sinks gradually to the bottom. If this be removed, and the liquor be drawn off cautiously from the sediment, it is evidently much altered in its properties. It is again become pretty clear, has lost much of its sweet taste, and has acquired one that is sharp and agreeably pungent, producing an exhilarating effect on the spirits; its specific gravity is diminished, so as often to be less than that of water, and it abounds with air.

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Such are the ordinary phenomena of vinous fermentation; but they are variously modified by circumstances, which now demand particular attention. These are chiefly the nature, quality, and quantity of the must, its degree of concentration, the quality and quantity of the yeast or ferment, and the temperature of the atmosphere.

1*st*, Different kinds of must pass more or less readily into a state of fermentation. The juice of the grape, at least in warm countries, and that of apples and pears, are easily fermented in a proper heat, without any addition of yeast; the juice of other fruits, and must prepared from sugar or treacle, also readily ferment, but, without great care, run speedily into the acetous stage, and form vinegar. These, therefore, require a ferment. Wort made from malted grain will not ferment well without yeast, and an infusion of raw grain scarcely at all without this addition, which it requires in considerable quantity. The quantity of the must is also a consideration of some importance, and experience has shewn that fermentation succeeds best when the liquor is in moderate quantity. Hence the vessels in which brewers set their worts finally to work are proportionally small, but numerous. This, however, is rather from convenience than necessity, as the large vessels in which the fermentation is begun are much less manageable.

2*d*, The *degree of concentration*, or density of the must, has an influence in accelerating or retarding fermentation. In the instance given above, the quantity of saccharine matter is sufficient to produce a vinous liquor of moderate strength, and to ferment readily. Were it to contain much less sugar, it would soon turn sour; and were it to hold much more in solution, the liquor produced would be stronger, but the must would not be so easily fermented. A saccharine fluid of the consistence of syrup can scarcely be made to ferment.

3*d*, *Quality, &c. of the ferment.*—*Yeast*, or *barm*, the substance usually employed for promoting fermentation, is the glutinous opaque *head* that rises on fermenting liquors. When good it is of considerable consistence, and may even be reduced to a dry state without losing its fermenting powers. It is a very heterogenous substance, as will appear from the following analysis of Westrumb. From 15360 parts of fresh yeast produced from beer, this chemist obtained 13 of potash, 69 of lime, 15 of carbonic acid, 10 of acetic acid, 45 of malic acid, 120 of vegetable extractive, 240 of mucilage, 480 of gluten, 315 of saccharine matter, 240 of alcohol, and 13595 of water. Which of these, or what combination of them, constitutes the fermenting principle, has never been completely ascertained. We know, however, that, in

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drying, the *alcohol*, *carbonic acid*, *acetic acid*, and *water*, are exhaled; and as wort contains much saccharine matter, and still requires yeast to work it, it can scarcely be supposed that any of these five principles contribute to the process, unless, perhaps, the combination of sugar with gluten, or extractive, may form a ferment. When yeast is suffered to stand for some time, there collects on its surface a quantity of matter between curd and gluten; and it has been supposed that this is the fermenting principle. But all this is at present hypothetical.

Yeast is of very different qualities, according to the way in which it is obtained. What flows over the edge of the fermenting vessels is considered the purest; and what collects at the bottom, as being mixed with the impure lees, is considered the worst. Porter-yeast, too, is not thought so good as that from ale and table-beer. Yeast, when kept in a fluid state, gradually loses its good qualities by becoming stale, and then must be used in greater quantity. For the purpose of brewing, fresh yeast is to be preferred. The activity of the fermentation depends also on the quantity of yeast employed, and is in general greater in proportion to this quantity.

4th, Temperature.—Nothing is of more importance to the success of fermentation than a well-regulated temperature, both in the liquor to be fermented and in the atmosphere of the place where the fermentation is carried on. Much below 50° no fermentation takes place; and if it be raised much above 70°, the vinous fermentation proceeds too rapidly, and speedily terminates in the acetous. In cold weather, it is found necessary to set the mash to work at a high temperature, sometimes as high as 70°; while in warm summer weather, during which brewing is seldom practised from choice, it is necessary to lower the temperature of the liquor as much as possible, to 50°, or even lower. This regulation of temperature is the more necessary, as the increase of temperature that takes place during the process is often very considerable; the liquor sometimes rising above 20° above the heat of the must, for which, of course, allowance must be made.

Effects of fermentation.—Without entering into a chemical explanation of the process of fermentation, which would here be out of place, we shall consider the nature of the changes that result from it. The sharp agreeable taste of fermented liquors is owing partly to the carbonic acid which most of them contain, and partly to the alcohol or ardent spirit which has been formed. All of them contain alcohol, though the proportion of this principle varies exceedingly, from small beer, in which it is scarcely to be detected, to the strongest Malmsey wine, which seems to contain it in the greatest quantity. Malt liquors, treacle, ginger, and more especially spruce-beer, cyder, perry, and Champagne-wine, abound in carbonic acid; while in the other liquors that have been enumerated, this acid is scarcely sensible, except when they have been improperly managed. The diminished specific gravity, or *attenuation*, as it is termed in the language of the brewery, is owing entirely to the alcohol produced, and is of course greatest in the *wines*, malt-liquors being proportionally less attenuated in consequence of their containing more undecomposed sugar in solution. This is particularly the case with the strong ales brewed in Edinburgh; in making which, fermentation is not carried nearly so far as in the home-brewed October of the south. Many wines, especially white wines, Malmsey, Mountain, Malaga, and most British wines, also contain much undecomposed sugar, and are hence called *sweet* wines; while those which contain little sugar are denominated *dry* wines.

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The *attenuation* produced in liquors by fermentation deserves particular attention, as it is in general a measure of their vinous strength. It is estimated by the specific gravity of the liquor taken before and after fermentation; and this specific gravity may be taken either by the common hydrometer, or by the saccharometer, to be afterwards described. The attenuation varies in the different liquors, being least in malt liquors, and greatest in the wines. Taking the specific gravity of water at 60° at 1.000, that of ale-wort varies from 1.0640 to 1.11275, and that of fermented strong ale from 1.0205 to 1.0500, or even higher. The average specific gravity of wort for making brown-stout porter is 1.0624; while that of brown-stout, after being some time bottled, is 1.0106. The average specific gravity of common porter-wort is 1.0500; and that of the brewed liquor is from 1.0130 to 1.0170.

PART II. PRACTICE OF BREWING.

Chap. I. Of the Apparatus employed in Brewing.

Utensils.—Before describing the processes of brewing, it will be necessary to say something of the utensils or instruments employed. These differ according to the nature of the operations, and the scale on which they are conducted.

Mills.—A mill is required for grinding or bruising many of the substances employed in brewing, as *malt*, *apples*, *pears*, *quinces*. For domestic purposes, malt is ground in a large hand-mill, so coarsely set as merely to break the grains into pieces, without reducing them to meal. In large breweries the malt mill is usually fitted with two iron rollers, between which the grains pass, and are thus sufficiently bruised. The cyder-mill consists of a circular block of hard stone, 9 or 12 inches thick, and from $2\frac{1}{2}$ to $4\frac{1}{2}$ feet in diameter, so fixed as to roll on its edge within a circular stone trough, the bottom of which is rather wider than the edge of the urn. In selecting stone for this purpose, care is taken not to employ limestone, as the acid of the fruit would dissolve a part of the stone. Sometimes the mill is formed of a strong square box, inclosing the usual grinding apparatus, supported on two stools, furnished with a hopper above for securing the fruit, and a spout below for letting out the juice that is squeezed from the apples, and generally worked by hand. In the large way, the former mill is placed in an apartment below

Apparatus. the apple loft; and in the floor of this loft is a trap-door with a tunnel leading from it towards the floor of the mill. A horse pushes round an axle on which the runner is fixed, and the pulp is occasionally stirred till it be sufficiently ground. The same mill answers for apples, pears, or quinces, and those pulpy fruits or roots of which domestic wines are made.

Press.—In making cyder, perry, grape, raisin, and parsnip wine, it is necessary to express the juice of the bruised materials with considerable force. For this purpose there is used a very simple press, consisting chiefly of a strong wooden frame-work, in which is fixed a stone floor at a convenient height, and having a stout moveable wooden plank connected with a very strong wooden screw, by the action of which the plank is made to press strongly on whatever is placed on the floor. It was formerly the practice to cover the floor of the press with lead, but as the acid of the fruit acts upon the lead, and produces a very deleterious substance, this is now generally disused. The press should be situated as near as possible to the mill, to prevent waste of liquor and loss of time. In pressing the fruit, &c. the pulp is placed on hair-cloth, and when ten or twelve layers are formed, the whole is submitted to pressure, by turning the screw by means of a long lever.

Boilers.—For heating water and boiling the liquor previous to fermentation, there are employed boilers, which are called *coppers*, from the metal of which they are generally made. In the small way, the copper need not be larger than to contain a hogshead or two, and may be of the ordinary cylindrical figure, having the mouth closed by a wooden lid in two parts. It is surrounded by brickwork, which serves both to support and defend the copper, and to heat it by a furnace below, while the smoke is carried off by a chimney behind. In public breweries, where the boiler sometimes contains 300 barrels at once, and where there are two, three, or even four of these enormous vessels in one establishment, the copper is a very complex structure, contrived for the purposes of economy and dispatch. The improved brewing-copper may be said to be composed of three principal parts; 1*st*, The body, which is a cylindrical or rather conical vessel, formed of immense plates of copper or cast-iron, fastened together by rivets of copper or wrought-iron, having a broad rim at the top, by which it is suspended on the surrounding brickwork, while its bottom, which is two or three inches thick in the centre, rests on strong jambs of brickwork, leaving a space round the copper for the flame and heat to circulate; 2*d*, A hemispherical dome, fitted close to the upper rim, so as to retain the steam, except what prudence requires should escape through a safety valve, and having a large cylindrical opening through which passes the shaft of an apparatus for stirring up the contents of the boiler, while it is so secured that the steam cannot be lost by this outlet; 3*d*, A cylindrical metallic vessel of considerable dimensions, made so as to cover the dome, except its central tube, and to be heated by the steam that rises into the concavity of the dome, and thus has its contents brought nearly to the required heat without waste of fuel. This last is called the upper copper, and is used for receiving the liquor that is afterwards to be boiled in the lower copper, to which it is admitted by holes furnished with valves, and opening through the dome. In large breweries the coppers are filled by pumps from a reservoir called the liquorback, and the boiled water or liquor is conveyed from the copper by means of tubes furnished with stop-cocks. Apparatus.

Mash-tub, or *Mashing-tun.*—To extract the fermentable juices from malt by hot water, brewers use a large tub called the *mash-tub* or *mashing-tun.* In domestic brewing this vessel is made to hold a hogshead or two, and is generally somewhat of a conical form, broadest at the bottom, where there is a hole for letting out the liquor. In the old way, this hole is made immediately through the bottom, near that side which is to be in front, and is closed with a wooden pin that reaches above the edge of the tub. This plug is covered with a long conical wicker basket, broadest next the bottom of the tub, and so contracted at the top as just to admit the top of the plug, and a wooden wedge for adjusting the plug, so as to enlarge or contract the hole in the tub. A better method, which is universally adopted in large breweries, is to have the mash-tub made with a false bottom, a few inches above the real bottom, pierced full of holes so small as not to allow the malt to run through, but to admit water to rise or fall through it. In large works the mash-tun is also a complex machine, and the body of it is sometimes formed of cast iron, with a false bottom of wood, and is supported upon iron posts, connected by the frame-work with a central column that is hollow, and forms part of a tube which brings the hot water from the copper into the space between the two bottoms, so that it may rise up through the holes into the body of the tun and wet the malt there contained. It is necessary during *mashing* frequently to stir up the malt to make the water act more fully on it; an operation which is easily performed in domestic brewing with a stick or small rake, and, in the large way, was formerly done by several men stirring up the *goods* (as the mashing malt is called), with long rakes, and afterwards agitating them with wooden paddles or oars. At present *mashing machines* are generally employed. These consist of a perpendicular axis or shaft, passing down the centre of the mash-tun, and having projecting from its sides arms to which are attached wheels, chains, and other apparatus, that, when the axis revolves by the action of machinery, stir up and agitate the goods.

It is now generally admitted that that the processes of brewing should be conducted in close vessels; and in the old way the mash-tub was covered with a wooden lid separated into two. The cover is now made as close as possible; and it has even been proposed to cut off all communication with the air, by inclosing the mash-tun within another vessel, with a space between, into which steam is admitted, so as to keep the contents of the tun at the same temperature. In public breweries the mash-tun is usually placed below the floor of the malt-loft, so that the malt is expeditiously introduced through a trap-door.

Apparatus.

The ordinary mash-tub may be employed in the making of those wines which require the ingredients to steep for any considerable time, as *raisin* wine.

Underback.—A tub or vessel, nearly of the same dimensions with the mash-tun, is placed below this to receive the liquor (*wort* or *must*), after the making is completed. This vessel is called the *underback*, and is formed of the same materials as the mash-tun. In the small way, it is merely a moveable tub, generally of an oval form, and furnished with two handles; in large works it is a fixed receiver, supported on brick-work, and having a pipe communicating with a pump, by which the wort, as it flows from the mash-tun, is drawn up into the upper copper. In private brewing the under-back is generally uncovered, but in public works it is deemed an object to have it close.

Jackback.—In large breweries there is an intermediate vessel called jackback, near the copper, for receiving the wort that has been boiled, and freeing it from the hops by means of a perforated plate within the vessel, before transferring it into the next vessels, into which it is conveyed by pumps. This is unnecessary in small concerns, and the wort when taken from the copper is only strained through a basket from the hops.

Coolers.—In order to reduce the worts to a heat proper for disposing them to ferment to the greatest advantage, they are placed in wide shallow vessels called *coolers*. In domestic brewing there is seldom more than one cooler, which is an oblong wooden receiver, sufficiently wide to contain about a hogshead, but only a few inches deep. It is usually hung at one side to the wall of the brewhouse by strong hinges, and to the other side are attached two strong moveable posts, for supporting it in a horizontal position when filled. At one end, and sometimes at each, near the front, is a hole, stopped by a wooden plug, for letting off the liquor when sufficiently cooled. In public breweries the coolers are very numerous, and proportionally larger and shallower than what we have described. They are situated on tiers above each other, and the walls of that part of the building are constructed with numerous open spaces to admit freely the external air, for the most expeditious cooling of the worts,—a circumstance of the utmost importance in extensive works, as, if the liquors were kept too long at a high temperature, they would become putrid, or *foxed*, as it is termed. When properly cooled they are drawn off from the coolers by pipes, and conveyed into vessels for undergoing fermentation.

Fermenting vessels.—In domestic brewing, the cooled liquors, or the must in making wines, is put into tubs of a size proportioned to the quantity, and these are loosely covered with lids or cloths. In the large way, there is a series of vessels of various sizes, and the liquor is transferred from one to another till it is finally left to work in the smallest. The largest vessel, or *gyle tun*, is usually of a square or oblong form. Into this the liquor is brought from the coolers, and from this it is conveyed into a lesser vessel or *back*; hence into a vessel called the *cleansing vat*; from this into the *working tuns*; and, lastly, into casks that are placed in double rows, in groups of four each, having tubes that unite, and pour the yeast, that would otherwise flow over, into pipes that convey it to a reservoir.

Apparatus.

Store-casks, or vats.—After the liquor is properly fermented, it is *tunned*, or transferred into vessels for keeping. In the small way, it is put immediately into the hogsheads, in which it is to remain till tapped or bottled; but in the large way it is first drawn into immense reservoirs, called *stores*, or store-vats. These are usually sunk in the ground, or inclosed within walls of brick-work, and are capable of holding many hundred barrels. One of them that burst lately in an extensive London brewery, produced effects like an inundation from a river, the liquor flowing from the breach, bursting through walls, and bearing down all before it. From these stores the liquor is raised by a pump, and the casks filled by pipes.

These form the principal apparatus of brewing; but there are several other implements both in domestic and public brewing which may be briefly noticed; as, a large funnel, made of wood, with a metallic tube for tunning the liquor into casks; a gauging rod, for ascertaining the quantity of liquor in the vessels; a *thermometer*, for taking the degrees of heat both of the liquors and the atmosphere; and a *saccharometer*, for ascertaining the strength, or rather density, of the *wort* or *must*. But these last three instruments require a little more examination.

Gauging-rod.—The brewer as well as the exciseman should be provided with *gauging-rods*; and in general there are more than one, for taking the quantity of liquor in barrels in the different vessels. The rod should be divided into inches and tenths of an inch, and when the capacity of any of the vessels is previously known in gallons or barrels, the quantity of liquor which they contain, at any given time, is easily ascertained according to the rules of mensuration.

Thermometer.—The thermometer used by brewers differs but little from ordinary thermometers, except in size and frame. It is larger, and the frame is of metal, with an open handle at top, to which may be attached a cord for letting down the instrument into the copper, &c. It may be filled either with spirit of wine or mercury; the former is more easily seen, but the latter is more accurate, as its changes of bulk are more equable. The scale, which in this country is always Fahrenheit's, need not range lower than 32°, the freezing point, or higher than 212°, the boiling point of water. But besides the common large thermometer, it is usual to have one of a smaller size, for accompanying the next instrument, and taking the temperature of liquors of which it is wished to ascertain the density. The use of this instrument is evident. It is now well ascertained that the various processes of brewing succeed best at certain temperatures. Provided with a thermometer, the brewer can of course act with more precision and a greater certainty of success.

Saccharometer.—This is one of the most important instruments employed in the improved state of brewing. It is a modification of the *hydrometer*, or *gravimeter*, that has long been in use for taking the specific gravity of ardent spirits, and acts on the same principle, that the less the specific gravity of any fluid, the deeper will a body sink in it, and the contrary; but the scale is different, and the degrees are adapted to shew the number of pounds of saccharine extract in each barrel (of 36 gallons) of liquor. There are various instruments of this name whose scales are different. Mr Richardson's was the first employed in this country, and modifications of that instrument by Dring and Fage, and by Atkins, have been much in use. Another by Dicas is said to be preferable, as being founded on more correct principles than Richardson's; and one contrived by Dr Thomas Thomson, and employed by the Excise officers in Scotland, is considered the most accurate. The instrument itself shews the specific gravity of the liquor in which it is immersed, and the weight of saccharine extract it contains is determined by means of a sliding rule that forms part of the apparatus.

The ordinary saccharometer consists of a copper ball, having a graduated scale rising from its upper part, while at the lower is appended a weight by a short cylindrical tube. For more conveniently making experiments, cylindrical tin vessels, called *assay-jars* are used, and of those, the most convenient is a double vessel communicating at one side, so that when the liquor is poured in the whole shall be of uniform temperature. When used, the jar is immersed in a case called a *refrigeratory*, for reducing the heat to 60° by cold water, and when, by the thermometer immersed in one jar, the temperature of the liquor is found to have fallen thus low, the degree to which the saccharometer sinks is noted, and the lower the saccharometer sinks the less saccharine matter the liquor contains.

Dr Shannon has given the form of a journal for noting the important circumstances that occur in the process of brewing, which may be advantageously adopted. The page is supposed to be ruled in ten or twelve columns for noting the following particulars; 1st, the *date* of the brewing; 2d, the quantity of *malt* used; 3d, the quantity of *hops*; 4th, the quantity of *wort in the underback*; 5th, the *gravity* of each wort that is drawn off; 6th, the quantity of fermentable matter contained in each wort; 7th, the quantity of cold wort in the coolers; 8th, the gravity of each wort in a fermentable state; 9th, the net aggregate of fermentable matter remaining in each wort at the above period; 10th, the amount of the fermentable matter extracted from each quarter of malt; 11th, the specific gravity of the liquor after the fermentation ceases; 12th, the amount of attenuation. Tables of a similar nature are employed by Drs Hope, Coventry, and Thomson, in the report made by them to the Board of Excise.

Having now described the principal utensils employed in brewing, it remains, before proceeding to explain the processes, to shew how those are arranged in the private brewhouse and an extensive brewery.

In most private brewhouses there is but one copper, capable of holding the quantity of liquor made at one brewing, which is generally a hogshead or two. As near as possible to the copper, stands the mash-tub, upon a gauntree sufficiently high to admit of the underback standing below it. At some distance from this part of the apparatus, generally along the opposite wall of the brewhouse, is hung the cooler, and sufficient room is left for arranging two or more fermenting tubs below it. If the vessels are large, there are generally moveable wooden spouts or gutters for conveying the liquor the more readily from one vessel to another; and a spout, communicating with a cistern without, is often introduced into the brewhouse.

Few manufacturing establishments are more interesting than an extensive public brewery. The great range of buildings, the enormous size of many of the utensils, and the ingenious contrivances for diminishing labour and expediting the various processes, cannot fail to astonish and delight the beholder. Some of these buildings are erected with arches below, where coals, casks, hoops, &c. are stowed away, and in some convenient part is sunk the well which supplies the establishment with water. Generally near the well is the engine-house, containing a steam engine that forms the great centre of motion for all the machinery employed. By this engine are worked the pumps, which raise the water to the summit of the building, where there is generally a large reservoir for containing it, and which extract the wort from the underbacks, or convey it to the coolers. By means of the same engine, the mills which grind the malt are set in motion, the machines contained in the mashing-tuns, and the apparatus for stirring up the contents of the coppers perform their several offices, and sacks of malt and hops are drawn up from carts and conveyed to the lofts where they are to be stored.

The principal floor of the brewery is occupied by the coppers, near which stand the large fermenting vats, or gyle-tuns, and jackbacks, and, at no great distance, the mashing-tuns, with each its under-back below. In one wing stand the immense store-vats, with smaller ones occupying the intermediate spaces; and in the other are ranged in double rows the cleansing-vats that are supplied from the large gyle-tuns. An upper floor is occupied with the malt-mill, and near it are large binns for containing the ground malt. Above these are lofts for containing the stores of malt and hops, the malt-loft being generally over the mill; and in the upper part of one wing are placed the coolers, one above another.

A very complicated apparatus is by no means necessary for brewing very tolerable liquor. We have known some notable housewives make excellent table beer, and very agreeable ale, with the following simple utensils. A large broth pot served for a boiler, and a firkin, or small cask cut in two, supplied the rest of the apparatus. The larger half of it formed the mash tub, while the smaller end answered the triple purposes of underback, cooler, and fermenting vat; a cask of sufficient dimensions to hold the produce of one brewing, and a few dozen of bottles to contain the liquor after it was sufficiently purified in the cask, completed the apparatus for domestic brewing; and the process was repeated whenever the cask had been emptied into the bottles. A similar apparatus answers very well for making small quantities of domestic wines and vinegar.

It will easily be supposed that all the utensils of the brewery, and the vats and casks in which the liquors are to be kept, must be perfectly sweet and clean; and indeed this is one particular in which some brewers and dealers excel their brethren, and never fail to find their account in it. Particular directions on this subject would be out of place here, but shall be given when the processes of brewing have been described.

Chap. II. Of the Processes of Brewing.

The processes of brewing are more or less numerous, and more or less complicated, according to the nature of the liquors intended to be produced. The brewing of malt liquors in general requires a greater complication of processes than the making of any other fermented liquors, and this shall form the subject of the first section.

Sect. I. *Brewing of Malt Liquors.*

Besides the preparatory operation of *grinding*, there are six steps of the process of brewing malt liquors to be considered, viz. *mashing*, *boiling*, *cooling*, *fermenting*, *cleansing*, and *tunning*.

I. *Grinding.*—In grinding malt the chief object is to break every grain sufficiently, without reducing it to the state of meal, as in that state it is very liable to what the brewers call *setting*, that is, clogging into compact masses when the hot water is mixed with it, a circumstance which prevents the water coming sufficiently in contact with every part of the malt, to extract from it all its saccharine principle. This setting also diminishes the *quantity* as well as the *strength* of the wort, by preventing so much of the impregnated liquor from escaping. The malt may be ground properly in a common corn mill, providing the stones are set at such a distance as to crush the grains without reducing them to powder; or this operation may be more certainly performed by means of the iron rollers mentioned above. For domestic purposes, nothing succeeds better than a large steel coffee-mill, set loosely; and even in extensive works, an apparatus on this plan may be adopted, of sufficient power for grinding six or eight quarters of malt per hour. It is usual, especially in home brewing, to have the malt ground some time before using it, but then it should be kept in a cool dry place. For domestic brewing the malt is often purchased from the dealer ready ground, and where the dealer can be depended on this is very convenient; but as it is more difficult to judge of the quality of the malt when ground than when entire, it is safer to purchase it in this latter state.

II. *Mashing.*—The process of mashing consists in infusing the malt in such a quantity of water, at a proper temperature, as may be sufficient to extract its saccharine and farinaceous principles, in the degree of concentration suited to the purposes for which the liquor is intended. The mode of conducting the process differs according to the apparatus. In domestic brewing the water is usually first put into the mash tub, and the malt is added when the water is of a proper temperature. Where there is not a false bottom, the conical basket and wooden plug, already described, are first fixed so that the hole in the bottom of the tub shall be completely stopped; and when the *grist*, or *goods*, as the malt is called, is introduced, the whole is well stirred for a considerable time. The tub is then well covered, and the goods are suffered to steep for two or three hours, according to the quantity. This is what brewers call the *standing of the mash.* In the large way, the *goods* are first put into the mash-tun, and the water, at the required temperature, is introduced from below the false bottom, through the holes of which it rises and penetrates through the goods in every direction. While this is going on, a continual agitation is kept up within the mash-tun, by the motion of the mashing apparatus, and the whole is left to stand for an hour or thereabouts, according to circumstances to be immediately noticed. In both ways, when the mashing is completed, the wort is drawn off into the underback, or, in the language of the brewery, the *tap is set*; and a fresh quantity of hot water is introduced among the goods, for a second mashing, which is conducted nearly as before.

The definition of mashing just given, suggests a variety of circumstances to which the brewer must attend in conducting the operation. These are chiefly, the *proportional quantities* of *malt* and *water*; the *temperature* of the latter; the *number of mashes* intended to be taken; the length of time which each mash requires.

1. *Proportions of malt and water.*—Supposing the copper full of water to be employed, which is generally the case, the proportional quantity of malt depends on the proposed strength of the liquor, and the time during which it is to be kept. In domestic brewing, where good ale is to be made, from six to eight bushels of malt to the hogshead is a very good proportion; and if the ale is to be very strong, and to be kept above a year, forming what is called *old beer*, ten or twelve bushels are often used to the hogshead. Where table beer is made from fresh malt, which is seldom done, two bushels to the hogshead is a good proportion, and less for small beer. In extensive breweries, where the copper holds from 50 to 300 barrels, from 25 to 150 quarters of malt are mashed at once. The whole quantity, either of malt or water, is seldom put into the mash-tun at once. It is thought best first to admit such a quantity of water, say one barrel to each quarter, as shall form, with the goods, a stiff mixture, which is well stirred before the rest of the water is added. This is called *stiff mashing*, and is thought to prevent the settling of the goods, while it ensures the full extraction of the principle of the malt. A small portion of the malt is kept out at first, and when all the water to be employed in one mashing has been introduced, this malt is sprinkled over the surface, and, gradually falling down through the water, imparts to it most of its goodness. The quantity of water that may be impregnated by any given quantity of malt, or, as the brewers speak, the *length that may be drawn*, depends much on the head and quality of the malt. In general, *pale* malt will bear a *greater length* than brown, and the better the malt the greater length may be drawn from it, provided the *goods* have not been allowed to *set*.

2. *Temperature of the liquor.*—Much of the success of brewing depends on the temperature of the water

employed in mashing. If this be too cold it does not extract all the virtues of the malt, and if its heat be too high it occasions the goods to set. The common mode of regulating the temperature, before the introduction of the thermometer, was, to *turn over* the water from the copper at a boiling heat, and to wait till the steam was so far dissipated that the brewer could see his face in the liquor. This is still commonly practised in home-brewing, but in the large way the thermometer is now universally employed. It is impossible to give any fixed rules for the regulation of temperature in brewing, as it depends on so many circumstances, some of which must now be briefly noticed. The *kind of malt* is to be considered, as pale malt will bear a greater heat without setting than brown, though, according to Mr Combrune, the higher the temperature to which the malt has been exposed in the kiln, the hotter may be the water in which it is mashed. Well made malt, or that which contains least gluten, will also proportionally bear hotter water. The absolute quantity of malt used, and its proportion to the water, have an influence; when a large quantity of malt is employed at once, it, of course, keeps its heat longer, and the mashing water need not be so hot at first; and the greater the quantity of malt in proportion to the water, the more is the heat of the latter reduced on being mixed, and, of course, the hotter it ought to be when turned over. Brewers seldom employ a lower temperature than 145°, or a higher than 195°.

3. *Number of mashes.*—As all the virtues of the malt can scarcely be extracted by one infusion, it is usual to have two, three, and sometimes four mashings from the same quantity of malt. In this case, the first two or three worts are commonly mixed together for strong beer, and the last is kept apart for small or table beer. At least this is the case in domestic brewing, for in public breweries it is not allowable to brew strong and small beer from the same grist, without adding a portion of fresh malt for the latter. In conducting these several mashings, brewers proceed after the following method: Let us suppose that a hogshead of beer is to be made from a quarter or eight bushels of malt. About half the quantity of water is first turned over, and the malt mashed with it when it is of the proper temperature, say 175°; after mashing for about two hours, at first with agitation, and afterwards close and at rest, the tap is set, and the specific gravity of the first wort is taken by the saccharometer, which we shall suppose 1.104, or about 97 pounds per barrel on Thomson's saccharometer. The same quantity of water at a higher temperature, say 180°, is now turned over on the grains; and after mashing for an hour or two, this wort is found of the specific gravity, 1.040, or about 36 pounds per barrel. These two worts, after having been separately boiled, as will be immediately explained, are mixed together for the principal liquor; and, in the mean time, a fresh quantity of hot water, at a temperature nearly equal to the fresh liquor, say 160°, is added to the same grains for table-beer, or liquor for *finings*. While the saccharometer is used for taking the specific gravity of the several worts in the underback, the quantity of each in barrels is to be ascertained by the gauging-rod, and noted, that the necessary calculations may be afterwards made.

4. *Duration of the mashings.*—It is evident that the longer the mashing continues, provided the temperature of the liquor can be preserved, the more completely will the wort be saturated; but in large breweries, where dispatch is of great consequence, it is an object not to waste more time in any of the processes than is necessary. Two or three hours is generally allowed for the first mashing, and a longer or shorter time for the subsequent mashings, according to the quantity of malt, the heat of the liquor, and the purpose for which the latter worts are intended.

III. *Boiling.*—The wort obtained by mashing, the composition of which has been already described, has several deficiencies, which are to be supplied by boiling. It is not sufficiently concentrated; it abounds too much in gelatinous, or rather albuminous matter, which would render it thick and turbid; and it wants that bitter aromatic principle which is to improve its flavour and make it keep. The objects of boiling are to evaporate the superabundant water; to separate the coagulable matter; and to impregnate the liquor with the requisite principles. For this purpose, in domestic brewing, the worts that flow into the underback are put into the copper, and boiled for an hour or two, with a proportion of hops. In the large way, the wort is pumped up from the underback into the upper copper, or *copper-back*, to be kept warm by the steam of the liquor in the copper till this latter is emptied of its contents, when the wort from the copper-back is introduced, and the hops added to it. In the mean time, the subsequent wort, as it flows into the underback, is pumped up into the *copper-back*, and so on till the whole boiling be completed.

In the process of *boiling* two circumstances are chiefly to be considered, the quantity of hops, and the duration of the boiling. The proportion of hops varies according to the kind of liquor, the time it is intended to be kept, and the heat of the atmosphere at the time of brewing. The stronger the wort, the hotter the weather, and the longer the beer is to be kept, the greater is the proportion of hops employed. For strong porter, twelve pounds of hops to the quarter of malt is a good proportion; but if the fermentation is to take place in rather a high temperature, more will be required. For ordinary porter, seven pounds per quarter is sufficient. For ales, from four to eight pounds per quarter are employed in England; but in Scotland a much less proportion is often used. We are informed that in Edinburgh the usual proportion of hops for very strong ale is one pound to every bushel of malt, that is, eight pounds per quarter; and for mild ale, one pound to a bushel and half, or about five pounds per quarter. Where table beer is made from fresh malt, it is usual to allow three pounds of hops to the quarter of malt in winter, and six pounds per quarter in summer. It is of advantage to inclose the hops in a coarse canvas bag, so that they be tied loosely in it; and the bag should be frequently agitated in the liquor. Thus the wort is impregnated with the virtue of the hops, while the liquor is more easily examined, and more

Processes. easily separated from the hops. This method, however, can scarcely be practised in extensive breweries, where several hundred weight of hops are often thrown at once into the copper. Then a sort of drainer, called the *hopback*, is employed for straining the boiled wort clear from the hops. The same hops are boiled successively with each wort; but, in this case, the first wort receives the most delicate parts of the hop, and the last its coarser and most resinous parts. The hops, after being used in the copper, may be employed as manure; and we may here remark, that the *grains*, or draff, left after mashing, form an excellent food for hogs and cattle.

The boiling is to be continued for such a length of time as may be sufficient to separate the coagulable part of the wort, and impregnate it with a proper portion of the bitter and aromatic principles of the hop. Brewers form their judgment of the worts being properly boiled by examining a little from time to time, and observing whether the coagulable matter is separating from the wort in flocks, leaving the intermediate liquor clear. This commonly takes place in from one to four hours, and is more easily effected in the early than the subsequent worts. It is usual to boil the first wort for porter one hour, the second two, and the third three or four hours. For fine ales, such as *amber*, *Burton*, and the sweeter Scotch ales, from half an hour to an hour is sufficient. In making small beer from fresh malt, the first wort may be boiled half an hour, the second an hour or an hour and half, according to the heat of the weather, and the third two or three hours with the same consideration.

The effect of boiling, in concentrating the liquor, is often very considerable, so as to reduce twelve barrels of wort to about ten of beer; and the specific gravity is of course greatly increased. The quantity remaining is estimated by the gauging-rod, and its gravity by the saccharometer. As much liquor is retained by the hops, it is proper, when the last wort is strained, to subject these to pretty strong pressure, though this circumstance is not sufficiently regarded.

IV. *Cooling*.—When the worts have been sufficiently boiled and strained, they are introduced into the coolers. In domestic brewing this is a very simple operation, and is easily performed. The boiled liquor is poured by pailfuls from the copper into a basket set on two sticks over the cooler, and, while the hops are retained by the basket, the liquor is gradually diffused over the cooler, and is not long in acquiring the requisite diminution of temperature. In the large way, every method is taken to hasten this important process, as, if it be protracted beyond twelve hours, the liquor would almost certainly be *foxed*. The coolers are therefore of great extent in proportion to their depth, and are situated in the most airy and exposed part of the premises; and the liquor, when pumped up into them, is never, even in winter, suffered to stand more than five inches deep, and in summer not more than two or three. In summer it is of consequence to cool the liquor as much as possible; and for this purpose it is put into the cooler at the coldest time of the twenty-four hours, which is about three o'clock in the morning; but in winter any time of the day will answer. The degree of temperature to which the liquor must be reduced depends much upon the season. It must always be below 80°, and above 40°, as, at the former heat, fermentation would proceed too rapidly, and the liquor turn sour, while, at the latter, fermentation will scarcely take place at all. Combrune lays down the following rules for cooling malt liquors. In July and August, and in June and September, if the weather be not unusually cold, the liquor should be cooled as low as possible (provided it does not lie in the coolers above eleven hours); in May and October it should be cooled to about 60°; in April, November, and March, to about 70°; and in February and December it may be near 80°. Of course, in this variable climate, where the seasons so often interchange, some latitude must be allowed; and it is a safe plan to keep as near the medium heat of 60° as circumstances will permit, especially when we consider that the heat increases during fermentation. Processes.

When such a diminution of heat, from 212° to 60°, takes place, often pretty rapidly, and where such an extent of surface is exposed, a great evaporation must ensue. This is sometimes so great, where large quantities of liquor are cooled at once, as to reduce the liquor one-fourth. As the part dissipated is only water, the strength of the liquor is thus greatly increased, and this circumstance is to be taken into account in computing the quantity made. It now appears that several losses of fluid take place in the processes of brewing. First, there is a loss during mashing of the water retained in the grains. This is generally supplied by the sprinkling of fresh hot water while the *tap is spending*. Next there is a loss during boiling, which can be allowed for only by employing more water in mashing than amounts to the quantity of liquor to be brewed. Then, again, comes the loss by evaporation during cooling, for which allowance should have been made at the same time; so that, in brewing any precise quantity of beer, the brewer must be guided by experience what allowance he is to make on all these heads.

V. *Fermenting*.—The *must* being now prepared by mashing, boiling, and cooling, is to be subjected to that operation by which it is converted into a vinous liquor. The process of fermentation, which has already been described in the former part of this treatise, properly comprehends both what the brewers call *fermenting*, or *working*, and the next operation of *cleansing*, these being but steps of the same process; but in the practical part of our subject we shall treat of each under the technical term.

In the domestic process of fermenting, the liquor is *let down* from the cooler into one or two fermenting tubs as soon as it has descended to the proper temperature, and a proper quantity of good yeast is mixed with it. The whole is then stirred well together, and the agitation is repeated occasionally till the fermentation is fully begun, when the whole is left to rest. The first sign of fermentation having commenced is a white line appearing round the sides of the tub, and gradually spreading towards the centre. By degrees the whole surface of the liquor is covered with a white scum, which becomes more and more dense, till it thickens into a head, while

Processes. the singing noise and increased heat, which mark the progress of fermentation, soon after take place. The working commonly goes on for two or three days, or till the head of yeast begins to fall in the middle, when the liquor is tunned without the intermediate cleansing used in the public brewery. Here the liquor is conveyed by pipes from the coolers to the gyle-tuns, or *squares*, which are not nearly filled, that sufficient room may be left for working. The quantity of yeast that is mixed with the liquor to bring on the fermentation is various, depending on the heat of the weather, the strength of the wort, the kind of liquor to be produced, and especially on the quality of the yeast. In cold weather more yeast is required to begin the fermentation than in warm weather; strong wort requires more yeast than weak, as being less liable to fermentation; and *ale*, as being generally less fermented than porter, is worked with a smaller quantity of yeast. Above all things, the goodness of the yeast will determine the quantity employed; for when the yeast is old or weak, three times the usual proportion will scarcely produce the desired effect. In general, one gallon of good yeast is sufficient to ferment nine or ten barrels of moderately strong ale-wort; and from this it will be easy to regulate the proportion for other worts, and under particular circumstances.

6*th*, *Cleansing*.—Cleansing, as has been already mentioned, is merely the last stage of fermentation, and is intended to prevent this process from going on so rapidly, or to such a degree as to produce vinegar. It is effected by dividing the liquor in the gyle-tun into several smaller portions, by turning it over into the cleansing vats, and by this its temperature is diminished. These vats are filled to the very bung-holes; and the yeast, that is still formed on the surface of the liquor, runs off by the bung-hole into the vessels prepared to receive it. As the yeast flows out, it carries along with it part of the liquor, and this is continually supplied as long as the cleansing goes on. Were it not for this precaution, the yeast would not separate properly from the liquor, or this would not *purge* itself well. While the greater part of the yeast is flowing out at the bung-hole, another portion of greater density sinks to the bottom, constituting the dregs or *lees* of the beer. The time at which the operation of cleansing should be begun, it regulated by the subsiding of the head in the gyle-tun; and the time of its continuance depends on the heat of the weather, and the quality of the liquor. When the weather is warm, and the liquor weak, a very short cleansing is sufficient; indeed, small beer is seldom cleansed at all in the brewery, but is immediately put from the gyle-tun into the cask in which it is sent out to the consumer or the retail-dealer; and in Scotland is almost immediately transferred into bottles for use. The cleansing of *ale* is not continued so long as that of *porter*, and the fuller the body of each the more cleansing it requires.

In cleansing, it is of great consequence to supply the waste in the vats, occasioned by working, as speedily as possible, to prevent the yeast from forming an extensive head on the surface of the liquor. In most breweries this is done in the following manner. The cleansing vats, or casks, are laid upon their sides on stillions, with their bung-holes uppermost, and one of the workmen goes constantly round with a vessel of liquor from the gyle-tun to fill them up. As this would be extremely inconvenient in a large establishment, a method has been contrived in the London breweries for doing this in a mechanical manner. A vessel, called the *cleansing batch*, from which all the vats are filled by branches of the same pipe, is left with a certain quantity of liquor in it, and a small square cistern is placed beside the batch, and communicates with the same pipe from which the vats are filled, and this cistern also contains a quantity of liquor, on the surface of which there floats a hollow copper-ball, connected, by means of an iron-rod, with a valve at the bottom of the cleansing batch. This valve is opened by the copper-ball lowering as the liquor in the cistern is diminished, and thus allows the liquor to pass into the vats by the pipe till the surface of the liquor in the cistern again becomes so high as to close the valve by the rising of the ball. From the top of each cask at the bung-hole rises a tube about six inches high, with a spout to conduct the yeast into the receiver below; and by the contrivance above described, the liquor is made to stand at a certain height in the tubes, so as to insure the yeast's not mixing with the liquor in the barrel. Processes.

Another, and simpler method of cleansing, has been proposed by a late writer. His cleansing vats hold each about five barrels. A small hole is bored in the upper end of a stave, just below the head-hoop, and just under this hole is nailed a piece of leather to serve as a spout for carrying off the yeast. There is a bung-hole at the top of the cask, which during the cleansing is kept closed, and only opened every morning and evening to supply the waste. This method may do well enough in small breweries; but the mechanical contrivance above described is certainly superior, and answers the great object of this writer, preventing the access of external air quite as well.

7*th*, *Tunning*.—When the cleansing is completed, the liquor is ready for *tunning*, that is, putting it into those casks, or store-vats, in which it is to be kept till sold or used. The process of tunning in private brewing is very simple. The casks being properly scoured and freed from all unpleasant smell, are set upon the stillion in the cellar, either on one end or on their side, according to the fancy of the owner. They are filled from the fermenting-tubs by means of a funnel, formed of a small tub, with a metallic tube fixed in the middle of its bottom. The casks are filled as full as possible, and the bung-hole is left open, that any yeast which may form in consequence of the agitation of tunning may escape. When the bung-hole is pretty clear, it is closely stopped, and only a small hole called the *vent*, is either left open or loosely stopped by the *vent-peg*, till all danger of working, or of any great extrication of air, is over. The peg is then knocked in, and the liquor left to fine itself.

In the large breweries, the liquor, after cleansing, is pumped from the vats into enormous stone-cisterns, or wooden stores, containing, in general, many hundred barrels, where it is kept till sent out to the dealer.

Fining.—When beer is left to itself, it is generally a considerable time before it becomes transparent or fines itself. In domestic brewing this natural fining is always waited for, at the same time that the liquor is supposed to improve by long keeping; but in extensive establishments, where it is an object to have a quick return, the brewer fines his beer artificially. This is done by a liquor called *finings*, prepared by dissolving a quantity of isinglass in sour beer. A certain portion of finings is sent with the barrels to the innkeeper, who pours such a quantity into each barrel as experience has shewn to be sufficient for rendering the liquor transparent. The isinglass, from its glutinous property, entangles the flocculent particles that render the liquor opaque, and forms with them a filmy net-work, which, in the course of a few hours, sinks to the bottom. The particular mode of preparing finings varies among different brewers. According to Mr Morrice, as much isinglass is to be added to a cask half full of bright stale beer as will fill it. After standing for some time, and being stirred about frequently to promote the solution, the isinglass is strained through a coarse sieve over an empty cask; and those parts of it that will not pass the sieve, are returned to steep again; so that, by repeated strainings, nearly the whole is got through. The cask of strained liquor is now to be filled up with some sharper beer; and, after standing till the whole of the isinglass seems dissolved, the liquor is to be passed through a finer sieve into a clean cask, and is then fit for use. Ale finings require the finest isinglass, but for porter an inferior kind is employed.

Colouring.—It has been already observed that, finding it more economical to use pale malt, brewers have contrived to heighten the colour of their liquor artificially, and we believe the practice very good. The *colouring* is usually prepared from sugar, melted over a clear fire, and then inflamed, so as to burn for a few minutes, when it is extinguished, and a sufficient quantity of water added to reduce it to the consistence of treacle. Some brewers used to prepare the colouring from the richest of their wort, boiled down to the consistence of treacle, and then set on fire. The result is much the same in both cases. This colouring is sometimes put into the liquor before sending out, at others is mixed with the finings. The quantity of colouring depends on the intensity of colour required to be given, but the usual proportion is from two to three pounds per barrel.

It is proper to remark here, that, by a late alteration in the Excise laws, brewers are prohibited from making their own colouring, this being now the employment of a peculiar manufactory, yielding an addition to the revenue of ten shillings per barrel.

Having thus detailed the general operation of brewing malt liquors, as practised both in domestic and public brewing, we shall conclude this section with some remarks on the principal kinds of malt liquors, and their preparation.

Ale is the sweetest, lightest coloured, and, in general, the brightest of the malt liquors. It contains most undecomposed sugar, owing to its fermentation not having been carried to its utmost extent; and from its being brewed with a less proportion of hops, it has but little of the bitter flavour. Its strength varies exceedingly, being determined by the proportion of malt employed. When good, it is of a fine amber colour, as transparent as the finest wine, of an agreeable sweet but pungent taste, a slight bitter flavour, and not too frothy. The ales of particular districts, as Burton, Dorchester, Windsor, Edinburgh, are most prized in this country.

In brewing ale, the malt is either altogether pale, or pale malt mixed with a small proportion of amber, and hard water is generally preferred to soft. Supposing the proportions of malt and water to be one quarter of the former to three barrels of the latter, and the brewing to take place at the usual season, the process is generally as follows: The whole malt is first mashed, for about three quarters of an hour, with two barrels of water, at a temperature of 170°, or 180°; and, after standing an hour longer, this first wort is drawn off. One barrel of water, at the temperature of 180°, or 190°, is then added to the goods, mashed for three quarters of an hour, and, after standing about the same time, this second wort is drawn off. A third mashing for half an hour takes place, with a barrel of water at about 160°; and this wort, after standing quiet for half an hour, is drawn off, either to be kept separately for table-beer, or mixed and boiled with the two preceding worts. In general the two first worts are boiled, each for about an hour, with the usual proportion of hops, which is about eight pounds per quarter of malt, upon an average. The boiled worts are then cooled down to 65°, or 60°, and pitched for fermentation either separately or together, according to the object of the brewer. If the third wort is intended for table-beer, it is fermented separately, with the precaution already noticed under *fermentation*.

We know that good ale may be brewed from malt and hops alone, but in the receipts given in books of brewing several other substances are mentioned as ingredients; thus, Mr Morrice, in his receipt for London ale, mentions grains of paradise, coriander-seed, and orange-powder; for Wirtemberg ale he orders honey, sugar, hartshorn shavings, coriander, and carraway-seeds. There is good reason to believe that sugar is often added, and when malt is very dear this may be done with advantage.

Table and small-beer.—In domestic brewing, table and small-beer, which differ only in strength, are very commonly made from the wort produced by the last mashing, but in public breweries they are more commonly prepared from the first. The following is Mr Morrice's method of brewing table-beer. He uses eight quarters of malt, of which six are pale and two amber, seventy-two pounds of hops, and twelve pounds of Spanish liquorice, which we presume might as well be spared. He mashes three times, first with about fifteen barrels at about 168°, for three quarters of an hour; second, with the same quantity at 172°, for half an hour; thirdly, with twenty barrels, at 158°, for half an hour. He boils the first and second worts together with the hops, and the third worts separately with the same hops, and pitches

Processes. these worts mixed together at 70°. Other brewers, to make eight barrels of table-beer, use one quarter of malt, which they mash four times; *first*, with two barrels, at 170°, for about an hour; *second*, with one and a half barrels, at 145°, for half an hour; *third*, two barrels, at 165°, for half an hour; and, *fourth*, three barrels, at 180°. These worts are boiled successively for one, two, and three hours, with six pounds of hops, and set to work with about five pints of yeast to each quarter of malt, at the temperature of about 55°.

Beer and porter.—Beer differs from *ale* in being of a darker colour, and more bitter, and generally a sweeter taste. There are various kinds, as amber beer, or twopenny, entire butt, or common porter, and brown-stout. There is also a table-beer of this description. Formerly beer was brewed with a large proportion of brown malt, but at present less of this is employed, the deficiency being made up by colouring. As porter is most in request of all the varieties of beer, the following observations will relate chiefly to that liquor.

It is generally allowed that the porter of the present day is much inferior to what was brewed previous to the late war, and, though there is considerable difference of opinion with respect to the causes of this inferiority, it is attributed chiefly to the increased tax on malt. The best porter is of a full rich flavour, not too bitter, nor at all acid, of a moderately dark colour, so as to be easily seen through, and not carrying too large or dark a head. It is brewed in the following manner: Supposing 25 quarters of malt to be employed for brewing about 90 barrels of porter, the proportions usually employed are either equal parts of pale amber and brown malt, or from 9 to 13 quarters of pale, and from 8 to 6 quarters of amber, and the same quantity of brown. The proportion of hops for this quantity is 1½ cwt. and, according to Mr Morrice, some brewers use 30 lbs. of Leghorn liquorice, and from 4 to 6 lbs. of *cocculus indicus* berry. Nearly the whole of the malt is first mashed, with about half the quantity of water, heated to about 150°; and after the mashing has continued from three quarters of an hour to an hour, and the liquor has been suffered to remain on the goods for about an hour, the first wort is drawn off, and put into the copper-back, at the head of the great copper. In the mean time, the second liquor, to the extent of about 36 barrels, has been heating to 160°; and after mashing with this half an hour or three quarters, and standing an hour, this second wort is drawn off. During this second mashing, the first wort has been boiling in the copper with the hops for an hour, while the third quantity of water, equal to the second, has been heating in the copper-back, and is afterwards let down into the copper till it acquires the heat of about 180°. The second wort being pumped into the copper-back, the third mashing takes place for about half an hour; and after the liquor has stood for about an hour, it is drawn off. The second wort is boiled for two, and the third for four hours. When liquorice is used, it is generally put into the copper, and dissolved in the second wort. All the worts are now mixed together, after being cooled to about 60°, and yeast in the proportion of five English pints to each quarter of malt is added. The fermentation in the gyle-tun continues for a day or two according to circumstances, and is then checked by cleansing. Some brewers mash each kind of malt separately.

Brown stout is a stronger kind of porter, requiring, of course, a greater proportion of malt and hops. The following is Mr Morrice's method of brewing it. He uses 20 quarters of malt, of which twelve are brown, four amber, and four pale, two cwt. of hops, with 28 lbs. of sugar, 14 lbs. of Spanish juice, four lbs. of *cocculus indicus*, and six lbs. of *faba amara*. It is presumed that the two latter may be omitted, and their place supplied by a greater proportion of malt and hops. The malt is first mashed with about 30 barrels, at 168°, for one hour and a half, and the liquor stands an equal time upon the goods. The second mashing takes place, with about the same quantity of water, at 174°, mashed for one hour, and standing an hour and a quarter. The first wort is boiled for two hours very briskly, putting in the *drugs* about a quarter of an hour before the boiling is finished. The second wort may be boiled three or four hours; and when the two are mixed together, there should be about 50 barrels. The liquor is cooled down to 66°, and set to work with a gallon of good yeast. Cleansing takes place the second day after brewing, when half a pound of salt and a little flour is added.

Mr Morrice recommends a quarter of fresh amber malt to be added to the grains, and table beer to be brewed, with 50 barrels of water, at 170°, mashed for an hour and a quarter, and standing as long upon the goods; the liquor to be boiled with the old hops, proceeding afterwards as before directed.

There is a kind of beer similar to porter, but brewed from *pale* malt, called *hock*, which is brewed with water at a higher temperature, and mashed for a longer time. This liquor is used chiefly to mix with other porter, to give it a peculiar strength or flavour. It may be here remarked, that though porter is called *entire butt*, from the idea that it all comes from one cask, it is the custom of porter-dealers to mix two or more kinds together, so as to suit the palate of their customers, some of whom prefer a mild, and others a hard porter. It is, therefore, common for the brewer to send a barrel of stale porter for every three or four of mild; and where draught porter is in request, both these kinds are tapped at once, and mixed by the drawer in the proportions required.

Amber beer, or twopenny, is prepared with about three parts of pale malt and two of amber, in the proportion of 25 quarters of malt and one cwt. of hops to about 80 barrels, adding, according to Mr Morrice, 30 lbs. of treacle, 20 lbs. of Spanish juice, with a proper quantity of *grains of paradise*, and *faba amara*.

SECT. II. *Of Beers made from Sugar.*

Of beers made from sugar, we shall particularly notice only three.

1*st*, *Treacle beer*.—A very pleasant beer, fit for family use, is made from treacle in the following manner. About five lbs. (or more, according to the strength required,) of treacle or molasses are dissolved in a sufficient quantity of hot water, while an ounce or two of good hops are boiled for a few minutes in about a quart of water, and the liquor strained. These two liquors are mixed together, and the quantity made up with warm water to about eight English gallons. When the mixture is reduced to a proper temperature, between 60° and 80°, a piece of toasted bread, well spread with good yeast, is put in, and the liquor left to ferment for two or three days, when it is turned into a cask, or bottled up for use. The quantity here directed will fill about three dozen bottles.

In fermenting liquors made from sugar, or the juices of fruits, the head of yeast is proportionally thinner, and less irregular, than that on the surface of malt liquors.

2d, Spruce beer may be prepared by adding to the above solution of treacle, before it be set to work, a 3s. 6d. pot of essence of spruce. The following is the receipt of a late writer for preparing spruce beer. Ten English gallons of water are boiled, and allowed to stand all night in a clean tub. In the morning, ten pounds of treacle are dissolved in a sufficient quantity of water, in a brass pan, over a clear fire. In this solution of treacle, a 3s. 6d. pot of essence of spruce is added, and after mixing well together, the whole is put into a ten gallon cask, with about half the boiled water, and an English pint of good yeast. The cask is them well shaken, and filled with the rest of the boiled water. After standing to ferment for two or three days with the bung open, filling it up occasionally with boiled water, the cask is bunged up for about a week, after which it is fit for bottling.

3d, Ginge rbeer.—Ginger beer forms a very pleasant and wholesome beverage in warm weather. It may be prepared in the following manner. Boil as much water as will fill a ten gallon cask, and let it stand all night. Dissolve ten pounds of lump-sugar in a brass pan with a sufficient quantity of water; and if the sugar be coarse, add the whites of two or three eggs to clarify it. When the liquor is freed from scum, add the paring of six lemons, and the liquor obtained by steeping half a pound of bruised ginger in a quart of warm water for a night. Boil these together for about twenty minutes, and put them into the cask with the juice of six lemons, a pint of good yeast, and about half the boiled water. The cask is then well shaken, filled with the rest of the water, and left to work for two or three days, filling it up occasionally. After this it is bottled and set in a cool place, and will be fit for use in about ten or twelve days.

SECT. III. *Of Wines.*

1st, OF WINES FROM THE JUICE OF THE GRAPE.—Notwithstanding the great variety of these wines, the general process for preparing them is much the same in all. The grapes are gathered when they have arrived at such a state of maturity as the nature of the proposed wine requires. For the rich, luscious, or very strong wines, such as Malmsey or Madeira, the grapes are not only suffered to hang till they are perfectly ripe, but are half dried upon the vine, by partially dividing the stalk, and thus preventing the flow of sap, while the heat of the sun exhales part of the water in the juice, leaving the rest in a concentrated state. For the drier and weaker wines, the grapes are gathered earlier, and in a more succulent state. In expressing the juice, regard is also had to the nature of the wine. For some that are intended to be austere, as port and claret, the stalks are pressed together with the grapes; for others, the fruit is carefully separated. They are generally first trodden by several men with wooden shoes, and then the juice is squeezed out by means of a strong screw. The expressed juice is sometimes suffered to stand several hours mixed with the husks; and for the darker wines, it is set to ferment under the same circumstances. The fermentation of the juice is continued, from a few hours to several days, according to the heat of the weather, or of the room where the process is conducted, and the nature of the grape, some kinds requiring a longer fermentation than others. The weak sweet wines are fermented less than the full bodied stronger wines, but those which are dry and sharp, as Hock and Rhenish have undergone the greatest degree of fermentation. During this process, where the husks are put into the fermenting vats, they form a solid cake on the surface of the liquor which remains tolerably clear below, but further purifies itself after being tunned into the casks in which it is to be kept. A perfect state of fermentation requires a proper regulation of the heat, and the addition of sugar, or of must, concentrated by boiling where the juice is too watery.

After the wine is put into the casks, it gradually diminishes in quantity, owing as is supposed to the wood of the cask imbibing part of its water, as it is observed that it grows stronger by keeping. It is necessary, however, to supply the waste and keep the casks full, and care is taken to fill them up with wine of the same quality. It is usual to add a quantity of brandy to the wine when tunned, and in some wines, especially port, the proportion of brandy is very considerable. The casks are kept in cool cellars, made as dark as possible, that the wine may not be rendered sour by the rays of the sun.

The fermentation of the must, when it is likely to proceed too far, and cannot be sufficiently checked by racking into fresh casks, is effectually impeded by what is called sulphuring. In the simplest form of this process, matches tipped with sulphur are introduced into a clean empty cask, set on fire, and suffered to burn as long as the air in the cask will support combustion. Thus the cask is filled with that peculiar gas called sulphurous acid, and while in this state the wine is racked into it, and shaken so as to be impregnated with this gas.

Many foreign wines, especially the white, are nothing but the juice of the grape properly fermented; but others owe their *strength* to a mixture of sugar or brandy; their *flavour* to the addition of aromatic, vegetable, or essential oils, and their colour to various colouring materials, as logwood, red sanders, oak-chips, cochineal, &c. added during the fermentation, as well as to allowing the husks to steep or ferment in the juice; or their colour is heightened by the addition of a very dark wine called *Vino-Tinto.* Indeed, several of these wines, as port and claret, are made *up*, as it is termed, of two or more wines; and this making up is effected, by mixing them while one or both is in a state of partial fermentation, when, by *fretting* together, the mixture is rendered more homogeneous and complete.

Defects of wines.—Wines are subject to certain defects or diseases, as they have been termed, which require notice. Weak and thin wines are liable to *fretting*, that is, renewed fermentation, which, if not checked by sulphuring, is best removed by the salt called *sulphite of potass*, in the proportion of a drachm to each pipe. *Acidity* in wine, arising from over fermentation, is not easily removed, though for this purpose lead in various forms has been employed, but as this is a dangerous practice, chalk is to be preferred. *Turbidity* is removed by clarifying, as will be presently described. The other defects are chiefly *ropiness* and *mustiness*, the former of which is counteracted, by exposing the bottles to air and sunshine, by agitation, the addition of a little vegetable acid, and clarifying, and the latter may be diminished by pumping in contact with carbonic acid.

Red wines.—In the table given at p. 5, only seven red wines are enumerated, not because these are *all* the red wines known, for there are many red wines having the same denomination as the white, as *Champagne*, *Frontignac*, &c. Those in the table, however, are the principal. Of these, *Tokay* is a wine of Upper Hungary, so called from a mountain, otherwise denominated *Hegy-alya*, on which the finest vines are produced. It is peculiarly rich, keeps well, and is very wholesome. It has been called *imperial*, from an idea that it is reserved for the Emperor's use; but it is made in considerable quantity, and is drunk by the wealthy in every country, especially Russia. *Burgundy* is the richest of the French red wines, and, is made chiefly in the upper province of that name. It is prepared with the greatest attention from select grapes, and under the superintendence of the magistrates of the district. This wine keeps well, and though very generous, does not contain a large proportion of ardent spirit. *Lacryma Christi* is an Italian wine, made in the kingdom of Naples, and is fat, sweet, and of a grateful pungency. *Red Port* receives its name from Oporto in Portugal, where it is usually shipped to this country. It is the strongest of all the red wines, from the large proportion of brandy mixed with it, but it is also one of the wholesomest from its astringency. The must from which this wine is made is completely fermented in the vat, and then the liquor is transferred into large tuns, containing each twenty-five pipes, and at this time the brandy is added. There is a red *Lisbon* wine similar to port, but richer and of a deeper colour. *Claret* is of a lighter body than port, but proportionally more astringent. It is made in several provinces of France, especially Bourdeaux and Guienne, though the claret of the latter is of an inferior quality. This wine, at least as we generally meet with it, appears to contain some acid. *Hermitage* is similar to claret, but much stronger, more generous, and less acid. It is made in the Northern provinces of France, especially Picardy. *Tent* is a Spanish wine, sweet and pleasant, but not very strong; it is made chiefly in the provinces of Andalusia and Gallicia. It is now in less demand than formerly, and is used chiefly at sacramental tables in cathedrals.

White wines.—Among the white wines, *Champagne* holds a high rank, not so much for its strength, as it contains less alcohol than most of the white wines, as for its briskness, pungency, and flavour. It is made chiefly in the French province from which it takes its name, and in order to secure its briskness, which is owing to the quantity of carbonic acid gas which it contains, it is bottled while yet in a state of partial fermentation. Hence, when the cork is withdrawn it mantles, but is not considered good if the bubbles of air stand long upon its surface. Considerable nicety is observed in the making of Champagne. The must is suffered to ferment in the vat for only one night, after which it is transferred into casks which are kept full, with the bung hole open for ten or twelve days, when the bung is driven close, but a vent hole left, and opened occasionally to discharge the superabundant carbonic acid. This is done for eight or ten days, when the cask is filled up with fresh wine, which is repeated once a week for about a month, and then once a month till the wine becomes clear. It is then transferred into a fresh cask, clear from the lees, and fined with isinglass; but if the wine shall prove too sweet, a fresh fermentation is first excited by rolling the cask, and thus mixing the lees with the wine. After standing in the new cask for about six weeks, it is again transferred clear from the lees, again refined, and in the month of March in clear dry weather it is bottled. About eighteen months after first bottling, the corks are drawn, and the wine decanted into fresh bottles soon after which it is fit for the market.—*Madeira*, so called from the island of that name, when genuine, is of the colour of fine Florence oil, and adheres to the glass, which it tinges with a light-bluish hue, and it has a kernelly taste, approaching to that of walnuts. Like other strong wines, it is prepared from grapes that have hung till they are perfectly ripe, and begun to dry, and a portion of brandy is added to the must before fermenting. It is repeatedly racked at intervals of a month or two, till March, fresh brandy being added at each racking, and it is then bottled for use. *Teneriffe*, is a Spanish wine, made in the island whose name it bears, and much resembles Madeira, except that it is weaker, and less unctuous. The wine called *Vidonia* is a variety of Teneriffe, made from a grape of that name. *Malmsey* is the richest of all the white wines, has a sweet taste, and a golden or brownish-yellow colour. It was formerly prepared only in the Grecian islands, but is now brought chiefly from those of Spain and Portugal. Thus there is a Canary Malmsey and a Teneriffe Malmsey; but that most in estimation is called Madeira Malmsey. *Sherry* is a Spanish wine, of a drier quality, and containing more brandy than those above-mentioned, and receives its name from the town of Xeres. In its preparation the grapes are sprinkled with slaked lime, and brandy is added before fermentation. *White Port* differs from red port only in colour, owing to the juice not fermenting on the husks. It is a wholesome, not unpleasant wine, consumed chiefly in Portugal. *Lisbon* is a pleasant wine, similar to sherry, Processes, but weaker. *Constantia* comes from the Cape of Good Hope and is made at the village of Constantia from a species of Muscada grape. It is of exquisite flavour, and prepared with the greatest care. There are two varieties, white and red. The wine called *Cape*, or *Cape Madeira*, is a dry and rather harsh wine, brought from the same part of Africa. *Hock* and *Rhenish* are German wines, both dry, but the former is much stronger than the latter, and takes its name from the village of Hockheim, upon the Rhine. These wines appear to owe their sharpness to a quantity of malic acid. The best hock, commonly called Old Hock, is reckoned very salubrious, being less heating, though more exhilirating than many weaker wines. *Mountain*, sometimes called *Mountain Malaga*, is a rich sweet wine, brought from the south of Spain. There are two varieties, the dry or well fermented, and the sweet or luscious. *Calcavello*, or *Carcavella* is a Portugal wine, very similar to dry Mountain, but weaker, and now in little request. *Frontignac* is a sweet, high-flavoured, French wine, made from the grapes of that name.

After this concise account of foreign wines, we proceed to the preparation of those called *Domestic*, among which is reckoned the *British grape wine*. This, as we shall presently see, might be brought to considerable perfection, even in our northern climate.

2d, Of wines from other fruits.—The manufacture of home-made wines, or *sweets*, is now carried on in this country to a considerable extent, though still capable of great improvement. Attempts have been made to imitate the foreign wines, and we continually see British port, sherry, champagne, &c. advertised by the dealers in made wines. Now, though these attempts have in many instances proved abortive, there seems no doubt that wines of a very superior quality to those commonly sold may be manufactured in this country. The chief defects of our ordinary domestic wines are, that they are either too sweet, from containing too much undecomposed sugar, or so thin as easily to become sour, that they have either no flavour, or have a disagreeable taste and smell, from the nature of the matter by which they are fermented. As it is agreed that the foreign wines from the juice of the grape are decidedly superior to all other, it is evident, that the nearer our wines can be made to approximate to those, the better must be their quality. Now, we know that the principal ingredients in the juice of the grape are, *water*, *sugar*, *tartar*, and *vegetable extractive*, and that the fruits of this country, if we except the grape, are deficient in the second and third of these principles, while they contain, in many instances, an excess of *malic acid*. The great object, then, in making British wines is, to supply the saccharine and tartarous principles, and so to manage the fermentation as at least to avoid unpleasant flavour; and where a dry wine is required, to decompose as much as necessary of the sugar. The concrete juice of the sugar cane, and in a few instances molasses or honey, are the saccharine substitutes employed in addition to the juice of our native fruits. The tartar commonly called crude, or unpurified, as it is collected from the casks of foreign wine, is preferable to the purified chrystals, or cream of tartar, as the former contains, in a dry state, a portion of that vegetable extractive which is necessary to insure the fermentation of the sugar. Many of our domestic wine-makers employ the yeast from malt liquors in fermenting their must; but this practice is highly exceptionable, as it gives to the liquor a bitter taste and unpleasant odour. Processes.

The processes of making domestic wines consist chiefly of *preparing the must*, *fermenting*, *racking*, *clarifying*, and *bottling*.

The *must* for these wines must be regarded as altogether artificial, being made up of the juices of fruits mixed with sugar and tartar. The manufacturers of these wines for sale are accustomed to prepare a fundamental sweet, from which, by the addition of certain colouring and flavouring substances, they afterwards produce the particular wines. This fundamental must is generally made from raisins, sugar, or molasses, or honey, water, and tartar; the molasses being used when a dark wine is required, and the sugar for white wines. For domestic purposes, it is better to employ sugar, in the proportion of two, three, or four pounds to each gallon of fluid, according to the proposed strength of the wine; and this fluid should consist, as far as possible, of the juice of some native fruit, observing that the riper and sweeter the fruit, the greater may be the proportion of its juice; for though unripe or acid fruits will make good wine with a sufficient quantity of sugar, the strong acids in those requires dilution before a perfect vinous liquor can be formed. The proportion of tartar should vary according to the deficiency of it, and the degree of sweetness in the fruit used; but in general from two to four lb. per cwt. will be a good proportion. In some cases no fermenting matter but that contained in the tartar and the fruit, is necessary, but in others it may be proper to introduce an additional vegetable extract, and it has been found that vine leaves answer this purpose extremely well; though if the scum or lees of former brewings of the same wine can be procured, these constitute the most advantageous ferments.

Fermenting.—There are some niceties in the fermentation of this *artificial* must which require notice, in *addition* to what has been observed under foreign wines. Where a still wine is to be produced, the fermentation may be carried on in comparatively open vessels; but when a brisk wine, in imitation of Champagne, is to be the result, the vessels should be as close as possible, consistently with their safety. When any peculiar flavour is to be imparted, as that of raspberries, cowslip, elder-flower, &c. it is of advantage to introduce these substances towards the end of the first fermentation, or during the second, which usually takes place on the return of warm weather; thus a smaller quantity of the flavouring matter is required, and a fuller and more delicate flavour secured.

Racking.—The operation of racking in wines may be said to comprehend both the cleansing and tunning employed in malt liquors. When the fermentation is to be checked, the liquor is transferred from the fermenting vat or cask into a fresh cask, and when effectual means are to be taken to prevent further fermentation, this cask is sulphured. Racking is also employed for decanting the wine from its lees, which is done either by means of a syphon, or by compressing the air in the full cask, by the following simple contrivance. A flexible tube covered with leather is fixed at one extremity to the cock of the full cask, and at the other to the bung-hole of an empty one. A pair of bellows is now fitted so as to be air tight to the bung-hole of the full cask, and by its continued action, such a quantity of air is impelled as forces the wine out by the top of the tube into the empty barrel, so as not to disturb the lees.

Clarifying.—As all wines take a considerable time to become clear, it is found convenient to hasten their clarification artificially. This may be done either by whites of eggs or isinglass, in the proportion of about 18 of the former, or 1 oz. of the latter, to 100 gallons of wine. The clarifying substance is mixed or dissolved in a small portion of the wine, and then incorporated with the rest in the cask by stirring.

Bottling.—Wines should be bottled in the spring before the subsequent fermentation, which usually takes place at that season, has proceeded too far. For this process, clear dry weather should be chosen, as the wine is then in its clearest state; and the same caution will apply to racking. It is common with the dealers in made wines to use inferior and shorter corks, but it is not easy to explain why the corking of these wines should be more negligently performed than those of foreign countries, which are not so liable to injury from this neglect. It is usual to introduce a raisin or a small piece of sugar into each bottle for the wine to feed on, that is, to keep up an insensible fermentation, which prevents the wine from growing sour.

It is common in making domestic wines to add a portion of *ardent spirit* before bottling, a practice which, to say the best of it, is useless. It indeed checks fermentation, but it renders the wine flat and heating. If any such addition be necessary, it should be made before the fermentation has proceeded too far.

Cleaning of casks, &c.—In the preparation of wines, equally with that of malt liquors, the greatest attention should be paid to the cleaning all the utensils employed, especially casks and bottles. In ordinary cases casks are easily cleaned by scalding them with hot water, and when new this is all that is necessary, but old casks are apt to contract a musty smell, or become decayed in the inside. The former defect is removed by slaking lime in them, and afterwards scrubbing and washing them, but the latter is best removed by the aid of the cooper.

Particular domestic wines.—Instead of giving many receipts for the individual domestic wines in this treatise, we shall make a few remarks on each, and point out the general procedure as exemplified in one or two kinds.

Currant wine.—Good wine may be made from each variety of currant, and that either ripe or unripe, the former making a still, the latter, if properly managed, a brisk wine. Forty lbs. of the *unripe* fruit, picked carefully from the stalk, are to be bruised in a tub capable of holding 15 or 20 gallons, so as not to break the seeds; four gallons of water are then to be added, and the whole well mixed and squeezed together with the hand, till the juice and pulp are separated from the husks and seeds. The whole is to remain at rest for a period from 6 to 24 hours, when it is strained with moderate pressure through a coarse flannel bag, adding about a gallon more water to the *mare,* and again pressing out the juice. Thirty pounds of white sugar are dissolved in the liquor, and the whole is made up with water to 10½ gallons, so as to fill a 10 gallon cask. It is set to ferment in a tub covered with a blanket and board, and after remaining a day or two according to the weather and the degree of fermentation, is to be racked into the cask, and treated as already generally described. For *ripe* currant wine, from 40 to 60 lbs. of fruit, according as the wine is to be sweet or dry, are used to 30 or 40 lbs of sugar, and about six ounces of crude tartar in powder are added to the expressed liquor; but little or no water should be employed. Black currants require to be brought to the boiling point with a sufficient quantity of water to prevent burning. *Grape.*—Grapes, like currants, may be employed either in the ripe or unripe state, and the process is much the same as above described, except that, (when unripe,) the whole bunch may be bruised together, and that no tartar is required; but as the fermentation is generally slow, it must be watched with patience, and increased by occasional agitation, without filling up too often. When the grapes are ripe the stalks must be left out, and no water used; and the proportion of sugar should be 1 or 2 lbs. per gal. according to the ripeness of the fruit. In this way, British grape wine may be made equal to Cape. Wine has even been prepared in this country from grape leaves and tendrils, especially those of the claret grape, using 40 or 50 lbs of leaves, infused for 24 hours in seven or eight gallons of boiling water, and dissolving in the expressed liquor 25 to 30 lbs of sugar, or more, if a dry still wine be required. *Gooseberry* wine is prepared from either ripe or unripe fruit, in the manner directed for currants, except that greater care must be taken to separate the skins from the *must,* more especially in their *ripe* state, as they impart to it an unpleasant flavour. Wine from unripe gooseberries resembles Champagne, and has been called *British Champagne.* *Cherries* make an agreeable wine, if care be taken not to break many of the stones, which impart too strong a bitter flavour. From *damsons,* and still more from *sloes,* may be made a rough wine, of good quality, which, by a mixture of currant wine, made up as formerly directed, resembles port. The *elderberry* produces an excellent red wine; but being deficient both in acid and sugar, requires the addition of this latter, and of tartar in considerable quantity. The berries should be brought to a boiling heat before expression. *Oranges* and *lemons* possessing an excess of citric acid, do not readily form a good wine, and the liquor commonly made from them is both too sweet and has too much flavour of the peel. These should be made in small quantities of two gallons or so. *Strawberries* impart little to a vinous fluid but their juice; and *raspberries* are best applied in the form of syrup, to give an agreeable flavour to *currant* and similar wines.

Processes.

Quinces, apples and *pears*, from containing so much malic acid, form vinous liquors of a peculiar nature. Quinces also possess a degree of acerbity which produces a rough wine, and, indeed, are seldom employed for that purpose. *Cyder* and *perry*, the vinous liquors resulting from the fermentation of apple and pear juice, are prepared in a similar manner. The fruit reduced to *pommage*, in the manner already described at pages 10 and 11, is expressed, and set to ferment at the temperature of about 50°, either in a vat closely covered, or in a cask, where it is suffered to remain till it becomes tolerably clear, and has acquired the vinous flavour. It is then transferred into a fresh cask, and exposed for a day or two in a cool situation. It is then racked into another clean cask, where it remains for the winter, unless a fresh fermentation takes place, discovered by a hissing noise, in which case it is again racked; and this operation is repeated when necessary, till March, when the liquor is transferred into bottles, or the vessels into which it is to be kept for use. The casks are filled up from time to time as the liquor wastes, and when bottled the corks are secured with twine or wire, to prevent being driven out by the air which is still produced. Good perry resembles French Champagne even more than the wine from unripe gooseberries, and, if we are rightly informed, has not unfrequently been sold for that expensive wine.

Raisin wine differs from the rest of our domestic wines in being prepared from a dry fruit, which contains little more than the saccharine principle of the grape, with perhaps a little astringency from the skins. The usual proportions for making this wine are, from two to seven pounds of raisins, and from half a pound to three or four pounds of sugar to the gallon of water. The raisins are cut, and sometimes boiled with the water, or steeped in it at a boiling heat. A quantity of tartar may also be added, and the liquor is usually fermented with the raisins, and afterwards squeezed out by pretty strong pressure.

The following receipt for making an excellent raisin wine has been communicated by a friend: Take to each gallon of water seven pounds of Malaga raisins, pick them from the stalks and chop them; put in half the quantity of water boiling hot, and let it stand three hours; run this off, pour on the remainder of the water, and let stand for a night; then run it off, and press the raisins as dry as possible. Put the whole into a cask, and, when it has done fermenting, stop it up for six months, *i. e.* if the wine be made in March or April, which is the best time, let it stand till October, then rack it off. If the thick part at the bottom of the cask be distilled, and the spirit be added to the must, it will improve the wine, and nothing will be lost.

3d, Of wines from sugar.—Of the wines enumerated in the table, page 5, as made from sugar, the first five consist of a simple vinous liquor, flavoured with the several substances from which they take their name. *Ginger* wine, according to the usual process, is, indeed, little else than toddy impregnated with ginger, as, from the quantity of spirit employed, the liquor can be scarcely said to be fermented. The best porportions are 30 lbs. of sugar, and 6 oz. of sliced ginger, boiled for a few minutes in 8 gallons of water, and when the liquor is near cold a pint of lemon juice, and the rinds of 6 or 8 lemons are added, and a sufficient quantity of lees, or scum of wine, to produce fermentation, and when this has continued two days, the liquor is put into a cask, with about two quarts of ardent spirit. For *cowslip wine*, a must is prepared with 3 or 4 lbs. of sugar to each gallon of water, and when the fermentation has proceeded sufficiently, some *cowslip* flowers, lemon-juice, and a little lemon-peel, are added. *Clarey*, *baum*, and *elder-flower* wines, are prepared in a similar mannar.

Birch, *palm*, and *parsnip* wines, are made from the juices of these vegetables, boiled with a sufficient quantity of sugar, the ordinary proportion of which is 2 lbs. to every gallon of juice, and fermented in the usual way; the fermentation is continued for a day or two, when the liquor is racked into a fresh cask, prepared with sulphur to check excessive fermentation. After standing for about three quarters of a year close stopped in the cask, it is bottled.

The vinous liquor called *Mead*, or *Metheglin*, when properly prepared, and suffered to stand for a sufficient time, much resembles *Mountain Malaga*. There are several varieties of mead, both simple and compound, the former being prepared with honey and water only, the latter with a mixture of other fruits, especially raisins, raspberries, and currants, and it is commonly flavoured with elder-flowers, or other aromatic plants. Several receipts have been given for making mead, but that of Mr Huish, as given in his late work on Bees, appears to be the best. His proportions are thirty pounds of honey to about nine gallons of water, which are boiled together till one half is reduced. He then puts two thirds of this liquor into a clean cask, rinsed with brandy, and the remainder into bottles, which are tied over with muslin. This bottled liquor is reserved for filling up the cask. The cask is set in such a heat as is sufficient to produce fermentation, which may be either that of a warm room or sunshine, and it is suffered to stand for about two months, filling it up from time to time, as the liquor wastes. When the fermentation has ceased, the bung is driven in, and the cask set in a cool place, where it should stand for two or three years before it be fit for bottling. Mr Shannon recommends the addition of tartar, in the proportion of four pounds to the hundred weight of honey.

To render mead purer, by abstracting from the must its peculiar honey flavour, and any acidity it may have contracted, Mr Huish advises to boil in the liquor first some chalk, and then some charcoal, each for about two minutes; and he clarifies the liquor, before fermentation, with the white of eggs. The clarification, however, would be better effected in the usual manner, with isinglass, after fermentation.

The consumption of mead in this country is now but trifling; but in some of the northern countries of Europe, especially Russia and Poland, where bees are very common in the wild state, it is the ordinary beverage of the people; though, from Mr Huish's account of its preparation there, it must be a most impure and naueous liquor.

BRIAREUS, in the mythological history of the ancients, a giant, the son of Æther, Titan, or Cœlus and Terra, and called on earth *Ægeon*, was at first serviceable to Jupiter, when Juno, Pallas, Neptune, and some of the other gods, conspired against his authority, and attempted to dethrone him; but he afterwards united with his gigantic associates for the same rebellious purpose; and as a punishment he was buried under Mount Ætna, which, according to the fable, throws out fire and smoke as often as he moves. Virgil represents Briareus with 100 hands, 50 heads, and breathing out fire.

BRIBERY, from the French word *bribe*, which, in its original meaning, signifies a piece of bread, or fragment of food taken off the table, denotes a reward which is given for the purpose of biassing the person who receives it in the discharge of a public duty. The term bribery, in a more enlarged sense, has been sometimes applied to undue influence in private transactions, but in general it is restricted to the effects of rewards, or the promise of rewards, to persons in public official situations, and particularly to those who are engaged in the administration of justice. By the law of England, bribery is punished, in the case of judges and officers of the crown, with forfeiture of treble the amount of the bribe, chastisement at the king's pleasure, and dismissal from office for ever; and on inferior officers the punishment is fine and imprisonment. By the law of Scotland, the offence of bribery, in judges of the supreme court, is punished with infamy, loss of office, confiscation of moveables, and discretionary punishment in the person of the offender; and in inferior judges and other persons it is punished with loss of fame and office, reparation of damages, payment of the parties costs, and discretionary censure, according to the nature and extent of the crime. In most countries where bribery is regarded as an offence, and a subject of punishment, the person who gives is considered as equally guilty with him who receives, and is exposed to the same penalties.—Blackstone's *Commentaries*, and Hume on *Crimes*.

BRICK, an artificial stone, composed of clay formed in moulds, and either dried in the sun, or baked or burnt in a kiln, for the purpose of building. In those parts of the world where stone is scarce, or the art of cutting it into proper forms is little known, the use of bricks is very extensive. In the earliest periods of society of which any record is preserved, bricks formed the materials of all buildings which were intended to be of a durable nature. They are alluded to in scripture history; one of the pyramids of Egypt is constructed of these materials; and the chief edifices of the Babylonians, the Greeks, and the Romans, in the early part of their history, were constructed of bricks. See Pottery.

BRIDGE, a structure of wood, stone, or iron, for the purpose of forming a convenient communication between the opposite banks of rivers. For the principles of construction, and for an account of some remarkable bridges, see Architecture.

BRIDGEND, a town of Glamorganshire in South Wales, stands on the opposite banks of the river Ogmore, and between which a communication is formed by means of a good bridge. The remains of ancient castles are still to be seen, and give name to some divisions of the town. The surrounding district is fertile and well cultivated, and the river abounds with salmon, trout, and other fish. The population is about 2000; and the manufacture of blankets and other woollen stuffs, by means of machinery, is considerable.

BRIDGENORTH, a town of the county of Salop in England, which is divided into the upper and lower town by the river Severn, on whose banks it is situated. The upper town occupies the summit and declivity of a hill, and consists chiefly of two spacious streets, from which others pass off towards the river, the bank of which is so steep that the passage is formed by flights of steps. Some of the houses are entirely excavated out of the sand-stone rock. The ruinous remains of walls, and a castle, indicate that it was once a place of some strength. A square tower of the castle, which, it is said, was undermined during the civil wars between Charles I. and the parliament, deviates, in a height of 70 feet, more than 20 from a perpendicular line.

The population is about 5000, and a large proportion of the inhabitants is engaged in the manufacture of leather, carpets, stockings, and hardware, in a cast-iron foundery, and in the building of barges for the navigation of the Severn. Placed in a central situation, in a rich country, Bridgenorth enjoys a considerable trade, which is greatly facilitated by water-carriage. The view from Bridgenorth, particularly from the elevated site of the castle, round which a fine terrace has been formed for the accommodation of the inhabitants, commands one of the finest and richly-wooded prospects of the western districts of England.

BRIDGETOWN, the capital of the island of Barbadoes in the West Indies, stands on Carlisle bay, in the south-west part of the island. Before it suffered from the destructive ravages of hurricanes and fires, Bridgetown was considered the most elegant town in the West Indies, and afforded almost all the conveniences and amusements of European cities. The streets are spacious, and the houses are lofty and well built. The church is a magnificent structure, furnished with a peal of bells, a clock of curious workmanship, and an excellent organ. Bridgetown has the advantage of a free school for the education of poor boys, and an hospital. The college, liberally endowed by Colonel Codrington, for maintaining professors and scholars to teach and study divinity, surgery, and physic, is the only institution of the kind in the West Indies. This college is, by the will of the founder, under the superintendence of the Society for the Propagation of the Gospel in Foreign Parts; and in the reports, presented to the House of Commons in 1812, it is stated that its funds were in a flourishing condition; but it is at the same time added, that the institution seems susceptible of considerable improvement; from which probably it may be inferred, that the objects in the contemplation of the founder have not been fully attained.

The population of Bridgetown, including the parish, exceeds 5000 whites, 1500 free persons of colour, and about 12,000 slaves. The harbour is spacious, and well secured from the prevailing north-east wind. Bridgetown is well defended against the attacks of an enemy; and it is the residence of the governor, and the seat of the public courts and offices of the island.

BRIDGEWATER, a borough-town of Somersetshire in England, is situated in a flat country on the banks of the river Parret, and at the distance of twelve miles from the sea. The communication between the opposite banks is facilitated by means of two bridges, one of stone and the other of iron. The streets are irregular, but they are spacious, and the houses are well built. St Mary's church is a fine structure, with one of the largest spires in the kingdom. A lofty cross is remarkable, by being surmounted with a cistern, from which water is conveyed to the different streets. The river is navigable to the town for vessels of 200 tons burden, and barges ascend as high as Taunton and Langport. The tide rises to the great height of six fathoms at high water and the influx, to the height of ten or twelve feet, is sometimes almost instantaneous. This impetuous flow, of which a similar effect is observed in the mouths of the Ganges, has received the same appellation of *Bore*.

The population, stated in 1801 at 3634, had increased in 1811 to 4911. Bridgewater enjoys a considerable coasting trade, and transmits to the interior parts of Devonshire and Cornwall the manufactures of Birmingham, Manchester, and Liverpool. Coals are imported from Wales, and distributed to the surrounding country; and the fairs, which are held four times in the year, are well supplied with cloths and linen, cattle, horses, and sheep.

BRIDLE, an apparatus variously constructed for regulating the motions of a horse, or keeping him under the restraint of the rider. The bridle originally was of a very simple construction, and consisted only of a cord or thong thrown round the head or neck of the animal. Reins for the management of the horse were in use among the ancients; but it has been doubted whether the curb or bit of modern times was known. The Roman youth were taught the art of guiding their horses while engaged in battle without bridles; and in some sculptures, as those on Trajan's column, soldiers are represented riding at full speed without the appendage of the bridle.

The improved bridle of the present day, composed of the reins, bit or snaffle, and curb, with the occasional addition of chains, is various in the form and dimensions of the different parts. The bit, or snaffle, which is one of the most essential parts of the bridle, and gives the rider great power in the management of the horse, is different in its form and appendages, and has received different names, as the Hessian, the Weymouth, or Pelham bit. The European bridle is usually plain in its construction; but in some countries, and particularly among eastern nations, it is often composed of very expensive materials, and sometimes adorned with a profusion of precious jewels.

It has been truly observed, that the inhabitants of those countries who are much accustomed to the management of horses, make little or no use of the bridle in guiding or directing their motions; and hence it has been justly inferred, that the coercive and harsh treatment of so noble and docile an animal as the horse might be dispensed with, and replaced by gentle treatment and judicious training.

BRIDLINGTON, sometimes called Burlington, is a sea-port town in the east riding of Yorkshire, in England, stands on a bay not far distant from Flamborough-head, and about a mile and a quarter from the harbour called Bridlington-quay. The houses are not of modern date, and the streets are not very regular. The church, of which the nave only remains, seems to have been a fine structure. The number of inhabitants exceeds 3000, and they are chiefly employed in the fisheries and other maritime affairs. Bridlington is a place of considerable resort, on account of its mineral waters and of sea-bathing.

BRIDPORT, a borough town of Dorsetshire; stands in a valley between two branches of the river Brit, about a mile north from Bridport bay. The streets are spacious, and the houses, of brick and stone, are well built. Of the public buildings, the market-house, in the centre of the town, a fine structure, the church of St Mary, a large ancient edifice, the charity-school, and some alms-houses, are the principal. The population, in 1811, was estimated at 3597. The manufacture of small cordage, nets, and sail-cloth, chiefly for the British and Newfoundland fisheries, and the building of ships, particularly smacks for the coasting trade between Scotland and London, furnish employment to the greater part of the inhabitants. An act passed in the time of Henry VIII. ordains that all the cordage used in the English navy should be made at Bridport, or within the limits of five miles. The harbour, lately improved, admits vessels of 200 tons burden.

BRIEF, a term in English law, denoting an abridgement of the case of a client, drawn up for the instruction of counsel in the management of a trial. Brief, in the law of Scotland, signifies a writ issued from the Chancery, and directed to any judge-ordinary, commanding and authorising him to call a jury to inquire into the case alluded to in the brief, and upon their verdict to pronounce a decision.

BRIEF, Apostolical, a letter addressed by the pope to princes and magistrates, relative to any public affair, and distinguished from a bull by being more concise, written on paper, and sealed with red wax. The form of the bull is more ample; it is written on parchment, and sealed with lead, or green wax.

BRIEG, a town of Silesia in Germany, and capital of the principality of the same name, stands on the left bank of the Oder. The houses are generally well built. The principal buildings are the Lutheran college, the academy, the arsenal, and several churches. The town was nearly reduced to ashes in the disastrous siege of 1741, when it fell into the hands of the Prussians, but it has been since repaired and fortified. Spinning and the manufacture of fine cloth have been introduced, and the trade in the wines of Austria and Hungary is considerable. The principality, which is from 12 to 20 miles broad, and about 35 miles long, produces corn, madder, and tobacco.

BRIEL, or BRILL, a sea-port town of Holland, and capital of the island of Voorn, is situated at the mouth of the Meuse, holds the fifth rank among the cities of Holland, and is celebrated in history as the place where the confederates of the United Provinces first established their independence in the struggle between the Dutch and the Spaniards, and laid the foundation of the republic. Being driven from the Low Countries by the Duke of Alva, they retired to England, and having hastily equipped a small fleet, they were compelled by Queen Elizabeth to depart from her territory, in consequence of the complaint of the Duke; and setting sail for the coast of Holland, they were driven, by an unfavourable wind, on the isle Voorn, and having attacked the town of Briel, they became masters of the place, which they afterwards fortified, and made the first asylum of their liberty. In the treaty between the States of Holland and Queen Elizabeth in 1585, Briel was delivered up to the English, in security for the performance of the conditions of the treaty, and was garrisoned by English troops till 1616, when it was restored. This city is also celebrated as the birth-place of the famous Admiral Von Tromp, who fell in a desperate engagement with the English fleet off the Texel, in 1653. Briel is 16 miles from Rotterdam, and 13 miles from Delft.

BRIG, or BRIGANTINE, an appellation denoting a merchant-ship with two masts; but the term is variously applied by different European nations to a vessel of a particular construction of their own marine.

BRIGADE, a term in military affairs, applied to a division or body of soldiers, either horse or foot, composed, when of cavalry, of eight or ten squadrons, and when of infantry, of four, five, or six battalions.

BRIGANTES, a people of Britain, alluded to by the Roman historians, and, according to Camden, occupying the northern counties of England.

BRIGGS, HENRY, an eminent English mathematician of the 16th century, was a native of Yorkshire, and was born in 1556; studied at Cambridge, and, having passed through the degrees of bachelor and master of arts, became at last fellow of his college. His predilection for mathematical science appeared early; and in 1592 he was nominated examiner and lecturer in mathematics, and was afterwards chosen reader of the physic lectures founded by Dr Linacre at Cambridge. Four years afterwards, when Gresham college, in London, was established, Mr Briggs was appointed the first professor of geometry; and while he held this official situation, it appears that his labours extended beyond the mere duties which it required; for he drew up a table for determining the latitude of places from the variation of the magnetic needle, which was published by Dr Gilbert in his treatise *on the Magnet*.

The name of Briggs is, in some degree, associated with the illustrious Napier in the improvement proposed by the former in the system of logarithms, the splendid discovery of which is owing to the latter, who announced it to the world in 1614. On this subject the two learned geometers first corresponded by letter; and in 1616 Mr Briggs visited Scotland, for the purpose of seeing and conversing with Lord Napier, and of discussing the alteration in the logarithmic scale which he proposed. The visit was repeated in the succeeding year; but as it seems

to be hinted, Baron Napier was not much disposed to admit any to a share in the discovery, or to allow Briggs the merit of the improvement to which he was entitled. Briggs asserted his claim in the preface to his *Arithmetica Logarithmica*, which was published in 1624, a work of great labour, which occupied a considerable share of the future part of his life.

In 1619 Mr Briggs was nominated the first Savilian professor of geometry at Oxford; next year he resigned his professorship in Gresham college, and retired to Oxford, where he spent the remaining years of his life, and died in 1630, when he had reached the venerable age of 74. For an account of his works, see Hutton's *Mathematical Dictionary*.

BRIGGS, WILLIAM, an eminent physician of the latter part of the 17th century, was a native of Norwich, studied at Cambridge, and, after travelling on the continent, settled in London. He was the author of a *Theory of Vision*, which was published by Dr Hooke in 1682; and at the suggestion of Sir Isaac Newton, then professor of mathematics at Cambridge, a Latin version of the same treatise appeared in 1685, with a recommendatory epistle by that great man prefixed to it; from which it may be fairly inferred that it is not destitute of merit.

BRIGHTON, or BRIGHTHELMSTONE, a sea-port town of Sussex in England, which, from being only a village chiefly inhabited by fishermen, has become a place of considerable extent, and of great resort for sea-bathing. It is chiefly built on a rising ground, with a gentle slope towards the east, and is well sheltered from the north and north-east winds by the South Downs. The new streets are regularly laid out, and are furnished with many elegant houses; but the chief ornaments of Brighton are the Steyne and Crescent, which consist of splendid lodging-houses, the Marine Pavilion, the magnificent residence of the Prince of Wales, the fine mansion of the Duke of Marlborough, a theatre, two elegant assembly-rooms, public libraries, a church and a chapel belonging to the establishment, and churches and meeting-houses for other denominations. The baths near the Steyne were erected in 1789, and are commodiously fitted up with hot, cold, vapour, salt-water, and air-pump water baths; and not far from the town a mineral spring, of a chalybeate nature, has been found useful to invalids who frequent the place.

The population of Brighton, estimated in 1801 at 7339, in 1811 exceeded 12,000; but this number, it is supposed, includes more than the permanent inhabitants, to whom the mackarel and herring fisheries afford the principal and often a very lucrative employment. Brighton also derives some advantage from its maritime situation, as being the station of the packet-boats between this part of the English coast and Dieppe in France; but the chief support of this place is derived from its baths, which for some years past have become a fashionable resort for the most distinguished company in the kingdom. Brighton is 55 miles from London.

BRIMSTONE, or SULPHUR, an inflammable substance; for the properties and combinations of which see CHEMISTRY.

BRINDISI, the Brundusium of the ancient Romans, and the scene of many important events connected with the history of that people, is a city of Italy in the Terra d'Otranto, and kingdom of Naples. The irruption of the Vandals was fatal to Brundusium, and it was nearly destroyed by the Saracens about the beginning of the ninth century. During the crusades it was the chief rendezvous of the armies collected in Europe destined for the conquest of the Holy Land, and recovered some degree of its former prosperity.

Of the ancient city, part of the light-house, a capacious marble bason, supplied with water from deers heads of brass, fragments of columns, pieces of coarse mosaic, inscriptions, coins, and ruins of aquæducts, are the only remains. The walls of the modern city include a spacious area, which is scarcely half occupied with inhabited houses. The streets are irregular and ill paved, and the houses are decayed and ruinous. The harbour of Brindisi is one of the safest and most commodious in the Adriatic, and from its local situation affords great facilities for commercial enterprize; but at different times it has been greatly injured by sinking ships and throwing in heaps of rubbish into the passage, to prevent the approach of hostile invaders.

The population of Brindisi is stated by some at 2000, and by others at 6000; but perhaps this difference may arise from the sad reverses to which this place has been subject by pestilential disorders, during some of which 1500 persons have been swept away in the course of a few weeks. This excessive mortality is ascribed to the noxious exhalations from the marshes in the neighbourhood. The soil in the vicinity produces vines, olives, and cotton; the latter of which furnishes employment to some of the inhabitants.

BRINDLEY, James, a celebrated English engineer, remarkable for the extraordinary powers of native genius, unaided by education; he was born at Tunsted, in Derbyshire, in 1716; and to the imprudence of his father in the management of a small patrimonial property, and his consequent embarrassment, the defects of the son's education are ascribed. Having finished his apprenticeship to a millwright near Macclesfield, in Cheshire, he commenced business for himself, and by his improvements in machinery, or by his own inventions, soon acquired the reputation of an ingenious mechanic. But the powers of his genius were not confined to the immediate business of his profession. The construction of a water-engine at Clifton, in Lancashire, for draining coal-mines, the improvement of a silk-mill in Cheshire, and some valuable additions which he made to the flint-mills in Staffordshire, fully established his reputation as an able engineer.

But the fame of Brindley is closely associated with the splendid works which were begun and carried on under his superintendence by the liberal and patriotic Duke of Bridgewater, who first introduced on a large scale the plan of inland navigation, which has proved of such incalculable benefit to the manufactures and trade of the kingdom; and in the construction of canals no difficulties were too great for the inexhaustible sources of his ingenuity. He carried them over wide vallies and large rivers by means of aquæducts, and through mountains by means of subterraneous tunnels. The first canal in which he was engaged was between the Duke's coal-works at Worsley and Manchester, for the purpose of supplying that town with fuel at a cheap rate; the plan was extended, and a similar communication was formed with Liverpool. The apparent advantages of water-carriage was so great that the proprietors and manufacturers of Staffordshire were induced to engage Mr Brindley to make a survey from the Trent to the Mersey, and, according to his plan, the canal was begun in 1766, and continued under his direction as long as he lived, and was finally completed under the management of his brother-in-law, Mr Marshall, in 1777. To this splendid undertaking he gave the name of the Grand Trunk Navigation, on account of the numerous branches which he supposed would in time be extended from it. This canal is 93 miles in length; and beside a great number of bridges thrown over it, has 76 locks, and five subterraneous tunnels, one of which, at Harecastle, is 2880 yards in length, and more than 70 yards below the surface of the earth.

Mr Brindley was engaged in many other works, chiefly of a similar nature. He was carried off in the year 1772, when he had reached his 56th year. Intense application, it is supposed, shortened his days, and induced a hectic fever, which rarely left him during the latter years of his life. For the common amusements of the world he had no relish, and therefore never indulged in them, or relaxed his mental exertions in devising the means for the accomplishment of the great plans which he had contrived or suggested. It was his practice, when any unusual difficulty arose in carrying on his works, to retire to bed, and sometimes to remain two or three days till he had surmounted the difficulty; and, without model or drawing, put the design which he had formed in execution. The fame of Brindley is finely commemorated in the poetry of Darwin:

> So with strong arm immortal Brindley leads
> His long canals, and parts the velvet meads;
> Winding, in lucid lines, the watery mass,
> Mines the firm rock, or loads the deep morass;
> With rising locks a thousand hills alarms,
> Flings o'er a thousand streams its silver arms,
> Feeds the long vale, the nodding woodland laves,
> And plenty, arts, and commerce freight the waves.
>
> *Botanic Garden, Canto 3.*

BRISAC, a town of Germany, and capital of Brisgaw, stands on the right bank of the Rhine, and was at one time a place of great strength, and the scene of many severe struggles for its possession between France and Austria. It was restored to the empire in 1715, and in the year 1741 the fortifications were entirely destroyed. Brisac is 40 miles from Strasburgh, and 27 miles north from Basle.

BRISAC, New, a town in the district of Colmar, stands nearly opposite to the former, and about a mile distant from the left bank of the Rhine. It was built by Louis XIV. and fortified by the celebrated Vauban. The population is stated at 2000.

BRISGAW, a district in the circle of Swabia in

Germany, extends along the east bank of the Rhine about 50 miles, and is about 30 miles in breadth, including within its territory Freyburg the capital, Brisac, Rhinmarck, and an island in the Rhine.

BRISTOL, from *Brightston*, the Saxon name, a city and sea-port, which stands on an elevated situation between the rivers Avon and Frome, partly in Somerset, and partly in Gloucestershire, in England; and, for opulence and commercial activity, is inferior to few towns in the kingdom, with the exception of the metropolis. Bristol lays claim to considerable antiquity. According to tradition, it was built nearly four centuries before the Christian era; but before the middle of the 5th century it is recorded as one of the fortified cities of Britain. It was surrounded with a wall, and defended by a castle, built about the middle of the 12th century; and, being regarded as a place of great strength, continued to be an object of importance to contending parties till the time of Oliver Cromwell, when the fortifications were razed to the ground by his order in 1665.

Bristol is about seven miles in circumference, and in one direction is about three miles long; about two-thirds of the space which it occupies belong to Gloucestershire; and the number of streets, lanes, courts, and squares, is computed at 600. The streets of the old town are crowded and less regularly disposed, and the houses are chiefly built of wood and plaster; but in the suburbs, and modern parts of the city, the houses, which are of brick or stone, are elegant, and the streets spacious and commodious. The chief buildings of Bristol are the cathedral, the church of St Mary Radcliffe, a fine Gothic structure, the exchange, the coffee-room, the theatre, the assembly-rooms, the guildhall, the mansion-house, and the custom-house, beside the infirmary, several hospitals, and other benevolent institutions. Bristol was erected by Edward III. in 1372, into an independent county, and since that period has received various privileges and immunities. The municipal government is entrusted to a mayor, twelve aldermen, justices of the peace, sheriffs, common-councilmen, &c. The bishopric was founded by Henry VIII.

The population of Bristol, which in 1801 amounted to 63,645, had advanced in 1811 to 71,297. The woollen manufactures, which were once flourishing and extensive, are now limited to serges and some other woollen stuffs; but the manufacture of glass is conducted on a large scale, as well as the refining of sugar and soap-making. Distilleries, iron-founderies, at which cannon are cast and bored, manufactures of brass, zinc, and lead shot, of white and red lead, turpentine, sulphur, and sulphuric acid, and of china-ware, have been established and successful. The manufactory of pins and other brass wares at Warmley, between Bristol and Bath, gives employment to many hundred persons; and the machinery is set in motion by two steam-engines.

Bristol has been long celebrated for commercial enterprize; the merchants of this city are extensively concerned in the West India trade, as well as with different parts of Europe. Its situation is peculiarly favourable; and the improvements which have been made of late years, in the navigation of the river and the formation of ample wet-docks, afford the greatest facilities to its commercial activity.

Bristol is a place of great resort during the summer months on account of its mineral waters. The spring rises at the bottom of St Vincent's rocks, close by the river, and about a mile west from the city; it is so copious that it discharges nearly forty gallons in a minute. The temperature is $74\frac{1}{2}$ Fahrenheit; and the saline ingredients with which the water is impregnated are muriate of magnesia, common salt, sulphate of soda, sulphate of lime, and carbonate of lime, beside carbonic acid gas. These waters are found highly beneficial in various diseases; and it can scarcely be doubted that the pure air and romantic scenery in the vicinity contribute their share to the restoration of the health of the invalid.

BRITAIN.

Introduction

No part of the inhabited globe, whether we consider its natural advantages, its national character, or its political importance, is more worthy of our notice than the island of Great Britain; and in sketching the principal features which it exhibits, we shall attend, first, to its statistics, and then to its civil history.

PART I. STATISTICS.

Chap. I. Name, Boundaries, Extent, and Division.

Name.—Etymologists are not agreed as to the origin of the name Britain, some tracing it to *Brutus*, or *Brito*, grandson of the Trojan prince Æneas, some to *Pryd Cain*, signifying a white form; some to *Brith*, painted; some to *Brydio*, rage; and others to *Barat Anas*, the country of tin. Without, therefore, presuming to decide between these different and discordant conjectures, let it suffice to observe that, in the time of Julius Cæsar, this designation was substituted for that of Albion, by which the island had been previously known.

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Boundaries and extent.—Britain is bounded on the south by the English channel, on the north by the Deucaledonian sea and Pentland firth, on the east by the British or North sea, and on the west by the Atlantic ocean and St George's and the Irish channels. It extends from 50° to $58^{\circ}\ 42'$ north latitude, and from $1^{\circ}\ 46'$ east to $6^{\circ}\ 30'$ west longitude from Greenwich, being about 600 miles in a straight line, from the Lizard-point to Duncansbay-head, and 310 from the South Foreland to the Land's-end; containing a furface of about 85,500 square miles, or 54,720,000 acres.

Division.—The river Tweed, the Cheviot hills, and the Solway firth, divide the island into two parts, called SOUTH and NORTH BRITAIN, or England and Scotland.

SOUTH BRITAIN, before the Roman invasion under Julius Cæsar, was parcelled out into *seventeen* petty states, each governed by a separate king. The 1st, including Cornwall and Devonshire, was inhabited by the *Domnonii;* the 2d, Dorsetshire, by the *Durotriges;* the 3d, Wiltshire, Somersetshire, and the principal part of Hampshire, by the *Belgæ;* the 4th, Berkshire, by the *Atrebattii;* the 5th, Surry, Sussex, and the sea-coast of Hampshire, by the *Regni;* the 6th, Kent, by the *Cantii;* the 7th, Gloucester and Oxfordshires, by the *Dobuni;* the 8th, Buckinghamshire, Hertfordshire, and Bedfordshire, by the *Catecuchlani;* the 9th, Essex and Middlesex, by the *Trinobantes;* the 10th, Suffolk, Norfolk, Cambridgeshire, and Huntingdonshire, by the *Iceni;* the 11th, the counties of Northampton, Leicester, Rutland, Lincoln, Nottingham, and Derby, by the *Coritani;* the 12th, Cheshire, Shropshire, Staffordshire, Worcestershire, and Warwickshire, by the *Cornavii;* the 13th, Radnorshire, Brecknockshire, Glamorganshire, Herefordshire, and Monmouthshire, by the *Silures;* the 14th, Caermarthenshire, Pembrokeshire, and Cardiganshire, by the *Demetæ;* the 15th, Flintshire, Denbighshire, Isle of Anglesea, Caernarvonshire, Merionethshire, and Montgomeryshire, by the *Ordovices;* the 16th, Yorkshire, Lancashire, Durham, Westmoreland, and Cumberland, by the *Brigantes;* and the 17th, Northumberland, by the *Ottadeni.*

Roman Provinces.—But after the Romans gained possession of South Britain, they divided it into four great provinces. These were, BRITANNIA PRIMA, comprehending that extensive tract from the English channel to the mouths of the Severn and the Thames; BRITANNIA SECUNDA, constituting the territory of modern Wales; FLAVA CÆSARIENSIS, extending from the Thames to the Humber; and MAXIMA CÆSARIENSIS, stretching from the Humber on the east, and the Dee on the west, to the wall of Adrian between the Tyne and the Solway firth. The remaining part was included in the province of VALENTIA.

Heptarchy.—Under the Saxons, who, about the middle of the fifth century, had effected a settlement in the island, England was divided into *seven* kingdoms, generally styled the HEPTARCHY. The names, commencement, and extent of these kingdoms were as follows. *Kent,* founded by Hengist in 455, embraced the county now distinguished by that appellation. *Sussex,* erected by Ella in 477, contained Sussex and Surry. *Wessex,* established by Cerdic in 519, included Cornwall, Devonshire, Dorsetshire, Somersetshire, Wiltshire, Hampshire, and Berkshire. *Essex,* erected by Erchewin in 527, comprehended Essex, Middlesex, and part of Hertfordshire. *Northumberland,* founded by Ida in 547, comprised Lancashire, Yorkshire, Durham, Cumberland, Westmoreland, Northumberland, and Scotland northward to the firth of Forth. *East Anglia,* established by Uffa in 571, embraced Norfolk, Suffolk, Cambridge, and the isle of Ely. And *Mercia,* erected by Creda in 584, included Gloucestershire, Herefordshire, Worcestershire, Warwickshire, Leicestershire, Rutlandshire, Northamptonshire, Oxfordshire, Staffordshire, Shropshire, Derbyshire, Nottinghamshire, Cheshire, and the remainder of Hertfordshire.

Counties.—After many violent struggles for the ascendancy, these kingdoms were, in 828, united under the dominion of Egbert, king of Wessex, when they were, for the first time, denominated *England,* a name of uncertain etymology. By his grandson, Alfred the Great, England was divided into 32 counties; each of which was originally governed by a *count,* who, on his dignity and title becoming hereditary, appointed a deputy, called the *shire-reeve, shrieve,* or *sheriff;* that is, the manager of the *shire, share,* or division. But this number has been since augmented to 40, and, including Wales, to 52 counties. These are the following: Four *southern* counties, Dorsetshire, Hampshire, Wiltshire, and Berkshire: Three *south-western,* Cornwall, Devonshire, and Somersetshire: Three *south-eastern,* Sussex, Kent, and Surry: Four *bordering on Wales,* Monmouthshire, Herefordshire, Shropshire, and Cheshire: Twelve *midland,* Bedfordshire, Buckinghamshire, Oxfordshire, Gloucestershire, Worcestershire, Warwickshire, Northamptonshire, Rutlandshire, Leicestershire, Staffordshire, Derbyshire, and Nottinghamshire: Eight *eastern,* Middlesex, Hertfordshire, Essex, Suffolk, Norfolk, Cambridgeshire, Huntingdonshire, and Lincolnshire: Six *northern,* Lancashire, Westmoreland, Yorkshire, Durham, Cumberland, and Northumberland: Six of *South Wales,* Glamorganshire, Brecknockshire, Caermarthenshire, Pembrokeshire, Cardiganshire, and Radnorshire: And six of *North Wales,* Montgomeryshire, Merionethshire, Caernarvonshire, Anglesea, Denbighshire, and Flintshire.

Three of these counties, namely, Durham, Cheshire, and Lancashire, are termed *counties palatine,* having been invested by the crown with regal rights and prerogatives. And, distinct from the counties in which they are situated, some cities and boroughs are styled *counties corporate;* the kings of England having annexed to them certain territories, and granted them the liberties and jurisdiction of counties. Of this description are the cities of York, Chester, Bristol, Norwich, Exeter, and Worcester, and the towns of Poole, Haverford-west, Southampton, Newcastle-upon-Tyne, Berwick-upon-Tweed, and Kingston-upon-Hull.

Counties, again, have been sub-divided into trithings, lathes, rapes, hundreds, tithings, wards, and wapentakes. By *trithings* is meant a threefold partition, such as that which still obtains in Yorkshire, where the appellation is now corrupted into *ridings.* Almost synonymous with trithings are *lathes* and *rapes;* the former of which designations is met with only in Kent, and the latter in Sussex. Every *hundred* includes a hundred families, and every *tithing* ten. The terms *wapentakes* in Yorkshire, and *wards* in Cumberland, Westmoreland, Northumberland, and Durham, are applied to small districts, whose inhabitants were, in ancient times, obliged to *take up weapons,* and to *watch* against the irruptions of their northern enemies, the Picts and Scots.

NORTH BRITAIN, at the time of the Roman invasion, was also divided into a number of petty states, inhabited by independent tribes of Aboriginal

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Britons: these were 21 in number. Together with Northumberland, the *Ottadeni* occupied the counties of Berwick, Roxburgh, and Haddington. The *Gadeni* extended over Selkirkshire, Peebleshire, most of Edinburghshire, and nearly all Linlithgowshire. Dumfries-shire, and Kirkcudbrightshire, westward to the river Dee, were inhabited by the *Selgovæ;* and the rest of Kirkcudbrightshire, and the whole of Wigtonshire, by the *Novantes*. The *Damnii* possessed Ayrshire, Renfrewshire, Lanarkshire, Stirlingshire, and the remainder of Edinburghshire and Linlithgowshire, with a portion of the shires of Dumbarton and Perth. The *Horestii* spread over the counties of Clackmanan, Kinross, Fife, and part of Perthshire on the south. The eastern side of Perthshire, the whole of Angus-shire and Mearnshire, northward to the river Carron, were occupied by the *Venricones*; while the rest of Mearnshire, and nearly the whole of Aberdeenshire, were inhabited by the *Taxaili*. The *Vacomagi* held Braemar in Aberdeenshire, the whole of the shires of Banff, Murray, Nairn, and the eastern part of Inverness-shire. The *Albani*, afterwards called *Damnii Albani*, inhabited Athol and Braidalbin in Perthshire, Glenorchy and Appin in Argyllshire, with a small portion of Lochaber in Inverness-shire. The *Attacotti* possessed Cowal in Argyllshire, and the most of Dumbartonshire; the *Caledonii*, the interior of the counties of Inverness and Ross; the *Cantæ*, the eastern parts of Ross-shire, from the Moray firth to the Dornoch firth; and the *Logi*, the south-east coast of Sutherland, from the Dornoch firth to the river Ila. Caithness-shire on the south, the east, and the north-west, was occupied by the *Carnabii*; its north-west corner, and part of the county of Sutherland, by the *Catini*; the interior of Sutherland by the *Mertæ*; its northern and western coasts, and a small part of the western shore of Ross-shire by the *Carnonacæ*; and the remainder of the western shore of Ross-shire by the *Creones*. The *Cerones* possessed the west coast of Inverness-shire, and a considerable portion of Argyllshire; and the *Epidii*, the south-west of Argyllshire, from Linne-loch to the Mull of Cantire.

Provinces.—During the Roman period, North Britain was divided into three provinces, Valentia, Vespasiana, and Caledonia. The first extended from the wall of Adrian to Graham's dyke, between the Clyde and the Forth: the second stretched over that tract of country which was bounded on the south by Graham's dyke and the Forth, on the north and east by the German ocean, and on the west by a straight line running from Loch Linnhe to the Moray firth; Caledonia comprehended the remainder, namely, the north-west corner of Argyllshire, and the whole of the counties of Inverness, Ross, Sutherland, and Caithness. But sometimes this last, in the middle ages styled Albania, embraced all the territory beyond the Forth and Graham's dyke; and at other times, in its most enlarged sense, all that part of the island northward of the Tweed, the river Eden, and the Solway firth.

Kingdoms.—On the departure of the Romans from Britain, Scotland was soon occupied by four warlike and independent powers. To the kingdom of Northumberland, formerly mentioned, belonged *Bernicia*, or Lothian, including the shires of Berwick, Roxburgh, Haddington, Selkirk, Peebles, Edinburgh, and Linlithgow. The *Cambrian* kingdom, or as it is most generally designated, the kingdom of Strathclyde, founded about the middle of the fifth century, reached westward from the counties now enumerated, to the Irish sea, and from the river Eden and the Solway firth to the Clyde, Loch Lomond, and the Forth. Subsequently to the Roman abdication in 446, the kingdom of *Pictavia*, inhabited by the Picts, descendants of the ancient Caledonians, spread over the whole region on the north of that boundary; and its extent continued undiminished, until a colony of Scots, sometimes called Dalriads, from Ireland, effected a settlement in Argyllshire and some of the circumjacent districts, where they established a kingdom in 503. After a struggle of 340 years between the Picts and the Scots, the latter prevailing, both were united into one sovereignty under Kenneth the son of Alpin. Strathclyde and Lothian, too, at length merged in the Scottish nation, and from that time the common country was denominated Scotland.

Counties.—The division of North Britain into shires or counties, unknown till the Scoto-Saxon period, which extended from the year 1097 to the year 1306, seems to have been gradually introduced as the Saxon colonists gained upon the Gaelic inhabitants. These counties, as they at present stand, are *thirty-two*, and taking in Orkney and Shetland, *thirty-three* in number. They may be arranged in the following order: Six *northern* counties, Orkney, Caithness, Sutherland, Ross, Cromarty, and Inverness: Fourteen *midland* counties, Argyll, Bute, Nairn, Moray, or Elgin, Banff, Aberdeen, Mearns, or Kincardine, Angus, or Forfar, Perth, Fife, Kinross, Clackmanan, Stirling, and Dumbarton, or Lennox: Thirteen *southern* counties, West-Lothian, or Linlithgow, Mid-Lothian, or Edinburgh, East-Lothian, or Haddington, Berwick, Renfrew, Ayr, Wigton, Lanark, Peebles, Selkirk, Roxburgh, Dumfries, and Kirkcudbright.

Chap. II. Aspect of the Island.

The island of Great Britain forms an irregular figure, not unfitly represented on the coins of Antoninus Pius and Severus, by a woman sitting upon rocks. Its shores, which are much deflected by deep inlets and projecting headlands, are in some places marshy, flat, and tame, and in others, bold, precipitous, and wild. In its general surface, the great diversity of its features presents to the eye a highly picturesque and delightful prospect. Here are extensive plains, laden with all the riches of luxuriant vegetation; and there gently rising hills, covered with waving woods, flocks of cattle, and fields of corn. Here are craggy and dusky mountains, burying their alpine heads in the clouds; and there, narrow winding ravines, with the foaming torrent tumbling, with terrific grandeur, down its steep and rugged channel. Here are beautiful lakes, whose pure and unrippled waters give back the sublime and enchanting landscapes on their banks; and there, majestic rivers sweeping their serpentine course through a long tract of country, and appearing at a distance like stripes of crystal amidst the surrounding verdure. The scene is not a little

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varied, enlivened, and adorned, by smiling meadows, bustling cities, towns, villages, princely seats, and pleasure grounds. But it will be necessary to attend more particularly to some of the more striking features.

Sea-coasts.—In proceeding eastward along the *southern* shore, from the Lands-end, a high rugged projection, the spacious bay of St Michael, soon opens on the view; and on doubling the Lizard point there appears a large semicircular sweep, including, among other inlets and capes, Falmouth haven, Rame-head, and Plymouth sound. Nearly opposite to Rame-head, about fourteen miles in the sea, are situated the Eddystone rocks, over which the waves frequently break with tremendous violence, and on which is built a strong light-house, for the direction of vessels entering and leaving the Channel and Plymouth sound. Between Prawle-point and Portland-bill, is another vast indentation, the most remarkable objects in the curvature of which are, Start-point, the bay of Dartmouth, Froward-point, Torbay, Hopes-nose, and the estuary of the Ex. Next follow Portland road, Weymouth bay, and St Alban's head. From this promontory to Selsey-bill, the coast is very much deflected by several creeks and headlands; among which are Peverel-point, Sandwich bay, Poole harbour, with an island in its entrance, Christchurch bay, Hurst cape, Southampton water, Portsmouth harbour, and a capacious basin interspersed with small islands. Opposite to the estuary of Southampton lies the isle of Wight, which forms, with the main land, a sheltered channel, consisting of the Needles passage, the Solent, and the famous road of Spithead. Beyond Selsey-bill, the shore in general takes a north easterly direction, and nothing remarkable occurs until Beachy-head, a bold and elevated point, makes its appearance. The only other objects which attract particular attention are the Rock of Hastings, Dunge-ness, and Dover-cliffs.

Off Kent, as we enter on the *eastern* coast, are the Downs, a road much frequented by ships, and defended from the heavy swells of the British ocean by the Goodwin sands, which are situated about five miles distant from Deal. Here a level sandy beach separates the high chalky rocks which face the coast, for a considerable way on each side of the South Foreland, from those which skirt the bold and rugged shore of the isle of Thanet, a place formerly detached from the rest of Kent by a navigable river, but now little more than a peninsula. The most easterly point of this isle is the North Foreland; between which and Orfordness, there is a vast gulph, into which the rivers Medway, Thames, Crouch, and Maden, discharge their waters, and along which, the shore, after passing the Shippey isle, is for the most part flat and marshy. From Orfordness to the spacious inlet called the Wash, the coast assumes a circular direction, and presents an intermixture of low ground, sandy hillocks, and clayey precipices. Crossing the Wash, and keeping the level beach of Lincolnshire, we come to the Humber, beyond which, to the firth of Forth, there are few indentations and promontories of any note. From Spurn-head to Flamborough-head, the coast is commonly flat; from this to Bamborough castle, it is first bold and precipitous, and then descends to low cliffs of sandstone and other materials; and from this again to Berwick-upon-Tweed, it is tame and sandy, but afterwards becomes bold and rocky, especially at St Abb's head, and westwards. Not far from the shore, opposite to the Northumbrian coast, appear the Coquet isle, the Fern isles, and Holy isle.

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Between Fife-ness and Button-ness, on the other side of the Forth, there is a considerable inlet, containing the estuaries of the Eden and the Tay. The land here rises gradually from the shore, which, for the most part, is rather high and rugged. Beyond this the coast runs N. N. E. with but few windings to Kinnaird's-head, and is generally bold, and sometimes lofty and precipitous. The Redhead promontory, in Angus-shire, rears its perpendicular front about 200 feet above the sea; and in the county of Mearns there is a stupendous eminence, called Fowls-heugh, about a quarter of a mile long, and nearly 300 feet high, whose base is beaten with fury by the swelling billows. But the bullers or boilers of Buchan, in Aberdeenshire, present an object of the most majestic and terrific grandeur. These consist of a spacious cavity, open at the top, formed by projecting rocks of immense elevation, and perforated towards the ocean by an arched way, through which the water rushes into the basin, where it foams and boils up like the ebullitions of a cauldron. A vast triangular indentation, including the Moray, Cromarty, and Dornoch firths, occupies the whole space from Kinnaird's-head to Duncansbay-head; and on both the land sides of the triangle, the shore is, with some exceptions, elevated, steep, and magnificent. On the eastern coast, particularly of Scotland, there are many excavations, or caverns, running far into the rocks, and which sometimes afford excellent specimens of stalactitic petrifactions.

The *northern* coast, which extends nearly 70 miles in a south-westerly direction, exhibits a bold and precipitous appearance. In some places the rocks, with which it is lined, rise to a stupendous height, frowning in sullen majesty over the sea below. Duncansbay-head and Dunnet cape, about 12 miles distant from each other, are two projections of very conspicuous elevation; the latter of which is not less than 400 feet above the surface of the water. To the northward of these projections, separated from them by the Pentland firth, are situated the Orkney islands; and a great way off, to the north-east, those of Shetland. Passing many bays, openings, and headlands, we arrive at cape Wrath, a dreadful precipice, which completely justifies the application of its name by the violence with which it repels the raging waves which dash against its proud and lofty front.

From cape Wrath to the Mull of Galloway on the *western* coast, the promontories and recesses are too numerous to be here particularly described. The most considerable are, Ardnamurchan's point, the most westerly projection of the island, Loch Linnhe, the Mull of Cantire, and that spacious bay into which Loch Fine and the estuary of the Clyde open. Along this stretch of coast, the shore, from which the ground often rises suddenly into mountains of alpine grandeur, is commonly bold, rocky, and dangerous. Opposite are the Hebrides or *Western isles*, the principal of which are Lewis, North and South Uist, Skye, Mull, Islay, and Jura; and, not properly included in this designation, are two beautiful islands, Bute and Arran, lying at the mouth of the Clyde. Between the Mull of Galloway and Braich-y-pwll point, where the shore is partly flat and partly bold and elevated, there is a wide inlet, containing, among other intrenchments, the bays of Glenluce and Wigton, the estuary of the Solway frith, Morecombe bay, and the estuaries of the Ribble, the Mersey, and the Dee. In almost the centre of this inlet is the isle of Man, and directly south from it the isle of Anglesey, separated from the main land by a long and narrow passage, called the Menai straits. Cardigan bay, another immense opening, stretches from Braich-y-pwll point to St David's head, presenting a coast in general rugged, mountainous, and wild; and between St David's head and the Land's-end there is another vast indentation, which gives space to St Bride's bay, Milford haven, Caermarthen and Swansea bays, Bristol channel, or estuary of the Severn, and Barnstaple bay. The beach along this tract continues mostly high and rocky; off from which there are some small scattered islands, of no particular note, if we except the isles of Scilly, which lie nearly 30 miles west from Cornwall.

Thus, it may be observed, the horizontal position of the island resembles somewhat the shape of a wedge, shelving from west to east, and may be considered as not unfitly represented in miniature by the Salisbury crags near Edinburgh.

Mountains and hills.—The mountains and hills form the most prominent feature in the face of a country; a feature for which Great Britain is eminently distinguished. On the south of the island a group called the Devonian range, stretches from the Land's-end through Cornwall, Devonshire, and part of Somersetshire, and rises at its greatest height to 1800 feet above the level of the sea; from which level the following admeasurements are also calculated. A ridge, likewise of considerable elevation, runs from the sea coast of Dorsetshire north-east to the county of Suffolk, with two lateral branches extending from the plain of Salisbury, the one to Sussex, where it forms the South Downs, and the other to the eastern shore of Kent. The Cambrian range, which traverses Wales from south to north, boasts of Plinlimmon in Montgomery and Cardigan shires, whose altitude is 2463 feet; the steepy Cader Idris in Merionethshire, 2914; and the cliffy Snowdon in Caernarvonshire, 3571. Another range, sometimes styled the Apennines of England, commences in Derbyshire, and terminates at Geltsdale forest in Cumberland, having a ramification shooting off on the north of Westmoreland towards the Irish sea. Of this range, in Westmoreland, Wharnside 2475 feet, Bonyfell 3084, and Ingleborough 2380,—in Yorkshire, Crossfell 3390, Bowfell 3440, and Helvellin 3225,—and in Cumberland, Grasmire 2865, Saddleback 3048, Skiddaw 3175, and Seafell 3240,—are the principal mountains. In different parts there are other hills and mountainous tracts of inferior note; such as the Chiltern hills, between Tring in Hertfordshire and Henley in Oxfordshire; the Malvern hills in Gloucester, Hereford, and Worcester shires; the Cotswold and Stroudwater hills in Gloucestershire; the Wrekin in Shropshire; the Morelands of Staffordshire, Yorkshire, Lancashire, and Northumberland.

The Cheviot, Tiviot, or Border hills, celebrated in the ballad of "Chevy Chase," for a battle between the Scots and the English under Douglas and Percy, run in a westerly direction, and form a continuous chain with those in the south-west region of Scotland. Many of the elevations in this chain are very considerable. In Roxburghshire, Cheviot Top is 2682, and Millenwood Fell 2000 feet; in Selkirkshire, Etterick Pen 2200, Windleshaw Law 2295, and Blackhouse Heights 2370 feet; in Dumfriesshire, Lauders 3150, Hartfell 3300, and Black Larg 2890 feet; in Kirkcudbrightshire, Criffel 2044, and Cairnsmuir nearly 4000 feet; and in Lanarkshire, Leadhills 1564, and Tinto 2368 feet. The rugged and heathy mountains of Tweedsmuir, in Peeblesshire, rise in Hartfield and Broadlaw to about 2800 feet; Loganhouse-hill, 1700 feet, is the highest of the Pentland ridge in Edinburghshire; and between East Lothian and Berwickshire, the Lammermuir chain, which terminates in St Abb's head on the eastern coast, has Soutra-hill, 1000 feet, for its greatest altitude. In Fifeshire, there is a small ridge, with two conical eminences, called the Eastern and Western Lomonds, the former of which is 1260, and the latter 1280 feet. An extensive chain, commencing at Dumbarton, and stretching in a north-easterly direction to the neighbourhood of Brechin, is by the Forth and the Tay broken into three divisions, denominated the Lennox, the Ochil, and the Sidlaw-hills. To the first division belong the Campsy Fells in Stirlingshire, 1500 feet; to the middle division, Dumiat, in the same county, upwards of 2000 feet, and Bencleugh, in Clackmannanshire, 2420; and to the last division, Dunsinnan-hill, 1025 feet, King's-seat 1400, and Kinpurnie, 1151, in Perthshire, and Craigowl, in Angus-shire, 1600. The Grampian range, so designated from the *Mons Grampius* of Tacitus, where the Caledonians were defeated by the Romans under Agricola, extends from Loch-Lomond, in Dumbartonshire, to Stonehaven, in the county of Mearns, having a branch shooting off from it into the shires of Inverness and Banff. Of this range Stirlingshire claims Ben-Lomond 3260 feet, Perthshire Ben-Ledi 3009, Ben-More 3903, Ben-Lawers 4015, Ben-Voirlich 3300, Bengloe 3725, and Shechallien 3564; Aberdeenshire, Loch-na-garaidh, and Binn-na-muich-duidh, which are constantly covered with snow, and not less than 4000 feet; Kincardineshire, Kloachnabane 2370, and Mountbattock 3465 feet; Inverness-shire, Cairngorm 4060 feet; and Banffshire, Benrinnes 2650 feet. It would be difficult to group the remaining mountains; because, from their irregular and insulated positions, few of them can be reduced to any distinct arrangement. Let it suffice, therefore, to mention some of the most remarkable, following the order of the counties in which they are placed. Ben-Cruachan, in Argyleshire, is 3390 feet; Ben-Nevis, in Inverness-shire, the loftiest mountain in Great Britain, raises its rugged front 4370 feet; Ben-Wyves, in Ross-shire, is 3720, and Benuaish nearly the same height; Ben-Hope, in Sutherlandshire, and the Pap of Caithness, are each of considerable elevation; the latter is 1920 feet.

Lakes.—Although many of the British lakes are well calculated to reward the visit of the traveller, yet comparatively few, in the southern division of the island, possess striking peculiarity of character, or exhibit features of wild and impressive grandeur. It is not among the fens of Huntingdonshire, Cheshire, and Lincolnshire, that these are to be found; but among the mountains of Wales, and particularly those of the north-west of England. Lyn Savadham in Brecknockshire, Bosherton-mere in Pembrokeshire, and Lyn Tegid in Merionethshire, are each worthy of notice; the first for the long thundering sounds which it emits on the bursting of the ice in the return of spring; the second for the rumbling noise heard from many parts of it before a change of weather; and the other for keeping within its banks, even on the reception of the most copious torrents, and for overflowing them when agitated by storms of wind. In Lancashire, Coniston-mere, six miles long, and three-quarters of a mile broad, has its shores finely indented by a succession of small bays; and, in connexion with the surrounding scenery, presents to the eye a soft and delicate landscape. Winder-mere, between the counties of Lancaster and Westmoreland, is in length 15 miles, and in average breadth one mile. The hills which hem in its borders generally ascend in a gentle acclivity, but in some places rise in abrupt and perpendicular rocks; and the romantic beauty of the picture is not a little heightened by the wooded islands which stud its waters. Ulls-water, between Westmoreland and Cumberland, is nine miles long, and upwards of one at its greatest breadth, and is unequalled in England for the vastness and sublimity of its accompaniments. Buttermere, in Cumberland, about a mile and three-quarters long, and half a mile broad, is formed by cataracts falling from a rock of stupendous height, and is guarded on the west by a ridge of rugged mountains which tower precipitately from its edge. To the north of this, Crummock-water expands itself into four miles in length, and nearly half a mile in breadth; and, for the interest which it excites, is indebted to the isles which rise from its surface, and to the rich and varied drapery of the mountains which skirt its sides. Derwent-water, three miles long and one and a half broad, and Bassenthwaite-water, four miles long, and a mile across at its greatest breadth, are highly distinguished for their picturesque and imposing beauties. The former of these two lakes, besides being decorated with islands, strikes the visitor with its brilliant transparency, and sometimes with its violent agitations without any apparent cause.

The lakes in Scotland, not to mention those *arms* of the sea by its inhabitants improperly called *lochs*, are more numerous, and in general formed on a grander and more extensive scale. Loch-Leven, in Kinross-shire, is a beautiful sheet of water, about 12 miles in circumference, interspersed with four islets, and is of great historical notoriety, both for the siege of its castle by Sir John de Stirling in 1335, and for being the spot where the unfortunate Mary Queen of Scots was doomed to close and rigorous confinement, after the battle of Pinkie, in 1567. For magnificence of expanse, richness of prospect, and pleasing sublimity of scenery, Loch-Lomond, in Dumbartonshire, stands unrivalled among the British lakes. It is 30 miles long, and nine at its greatest breadth, and is adorned with about thirty mountainous and romantic islands, supposed a continuation of the Grampian chain, which terminates on its western shores. At the south end its depth is seldom more than twenty, but north from the foot of Ben-Lomond is from sixty to a hundred fathoms. Eastward from this, in Perthshire, lies a group of lakes, imbosomed among those rugged and stupendous masses, called the *Trosachs*, forming a landscape which, for its rude and gloomy grandeur, exceeds all the powers of description. Of this group Loch-Catherine, ten miles long and one and a half broad, is the largest and most celebrated: Bold and rocky islands rise from its clear and unrippled waters. In the same county, Loch-Erne, eight miles long and one and a half broad; Loch-Tay, 15 miles long and two where widest; Loch-Rannoch, 12 miles long, and from one to two in breadth; and Loch-Ericht, 14 miles long and nearly one broad,—present in general a mixture of the soft and bolder features of nature. Loch-Awe, in Argyleshire, about 30 miles long, and two at its greatest breadth, contains a number of beautifully wood-tufted islands, and affords a view, perhaps the most picturesque of any to be met with in the kingdom. Inverness-shire boasts of Loch-Laggan, about 12 miles in length, and one and a half in breadth; Loch-Lochy, 14 miles long, and two where broadest; and Loch-Ness, 22 miles in length, and nearly three at its greatest breadth, and from 60 to 135 fathoms deep, surrounded with grand and magnificent scenery. There are many lakes in the three northern counties; but the enumeration shall here close with the mention of Loch-Mari, in Ross-shire, 16 miles long, and from one to two broad; and Loch-Shin, in Sutherlandshire, 20 miles in length and two at its greatest width.

Rivers.—The rivers which water and fertilize the island of Great Britain, are too numerous to be particularly noticed. By far the largest and most commercially important is the Thames, which originates in a copious spring on the confines of Gloucestershire, two miles south-west from Cirencester; and having received, in a circuitous course of 160 miles, seventeen tributary streams, falls into the British ocean between Kent and Essex, and is navigable for 130 miles. The Severn, from its rise in Plinlimmon mountain, takes a semicircular sweep through the counties of Montgomery, Salop, Worcester, and Gloucester, to the Bristol channel, into which it discharges itself, after increasing its waters by its junction with other rivers. It admits barges as far as Welch-pool. Commencing in the northern extremity of the Peak in Derbyshire, the Mersey flows in a north-westerly direction; is augmented in its progress by the Irwell near the village of Flexton, and by the Weaver at Frodham, where it forms a basin; and, for vessels of considerable burden, is navigable from Liverpool to the mouth of the Ir-

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On the south of Scotland, the Annan; springing from the Moffat hills, and passing through a tract of thirty miles, falls into the Solway firth; into which also the Nith, from the elevated land of Ayrshire, discharges itself. Tweedsmuir, in Peeblesshire, gives birth to the pastoral river Tweed, which, after its meeting with other streams, loses itself in the ocean at Berwick. The Forth has its source near the foot of Ben Lomond, and, moving onwards with many beautiful windings towards the east, and increasing its volume in its progress by the accession of the waters of Teath, Allan, and Ardoch, it expands below Alloa into a capacious firth of unequal width. Opposite to Limekilns it is *three* miles, to Queensferry *two*, to Leith *seven*, to Prestonpans *thirteen*, and to Dunbar *fifteen* miles in breadth. At its mouth lies the isle of May; and further up are the Bass, Inchkeith, Inchcolm, Cramond, and Inchgarvie. It is navigable to Stirling bridge for vessels of 30 tons, and to Grangemouth for ships of any burden. The river Clyde flows about 81 miles from its origin in the southern borders of Lanarkshire, and, opposite to Cowal in the county of Argyle falls into the firth which bears its name, forming in its course, in the vicinity of Lanark, those wonderful and stupendous cascades called the *Falls of the Clyde*, and affording an easy navigation for small-craft to the city of Glasgow. Issuing from its source in Braidalbin, in the western confines of Perthshire, the Tay, swelling as it moves along by the tribute of many streams from the mountains, pours into the sea, between the shires of Fife and Angus, a greater quantity of water than any other river in Britain, and admits vessels of considerable size as far as the town of Perth. The only other rivers of note which remain to be mentioned are the Dee and the Don, which, proceeding from the Grampian mountains on the west of Aberdeenshire, mingle with the ocean, the one at New, and the other at Old Aberdeen; and the Spey, which, from its rise in Badenoch in Inverness-shire, flows with a rapid current down its declining channel in a north-easterly course into the Moray firth.

Statistics. *Canals*.—The commercial interests of Britain are greatly promoted by means of numerous canals, which in the southern parts of the island run in almost every direction. Passing by Stroud to Lechlade, one joins the Severn and the Thames, and from the latter of these rivers canals stretch into various quarters. The Grand Trunk, uniting the Trent and the Mersey, was begun in 1760 and completed in 1777; it sends off many branches, and opens an important communication between most of the principal cities and towns in England. Another canal reaches from Chesterfield in Derbyshire to the Trent at Stockwith; another from Liverpool to Leeds, in a winding course of 117 miles, with an arm extending to Manchester; and a third from West Houghton in Lancashire to Kendal in Westmoreland. The earliest canal of which there is any authentic account, is that between Liverpool and the coal-pits at St Helens, for which an act of Parliament was obtained in 1755. But besides those now mentioned there are others in England, though chiefly of inferior consideration.

In Scotland the canals are but few, and of course inland navigation is conducted on a less extensive scale. The principal canal yet opened was finished in 1790, connecting the Forth and the Clyde, and affording a passage between the British and Atlantic oceans, for vessels not exceeding nineteen feet of beam, nor drawing more than eight feet of water. From it a branch, called the Monkland canal, runs twelve miles into the country, touching Glasgow on the north-east. Between this city and Ardrossan bay, by the way of Paisley, another has been long projected, but has hitherto been carried no farther than the village of Johnstown; and between Edinburgh and lock sixteenth of the Forth and Clyde canal, the Union canal, recently sanctioned by an act of Parliament, is to extend. In Argyleshire there is a small one about six miles long and nine feet deep, which joins Loch-Crinan with Loch-Gilp, an arm of Loch-Fine; and from Loch-Linnhe, the Caledonian canal, which is now in a state of considerable forwardness, proceeds through Loch-Lochy, Loch-Oich, and Loch-Ness to the Moray firth. Of this canal the surface width is 110, the bottom width 50, and the depth 20 feet.

Chap. III. Natural History.

The natural history of Britain opens up a wide field of interesting research; but the following observations on its different branches must of necessity be very general.

Meteorology.—Although the geographical position of the island be within the northern region of the temperate zone, yet it is by no means exposed to such extremes of heat and cold, as are experienced in parallel latitudes on the continents of Europe, Asia, and America. The cause of this mediocrity of climate is doubtless to be traced, partly to the shelter and reflecting surface of its mountains and hills; partly to the high state of cultivation at which it has arrived; and partly to the tepid breezes, wafted from the surrounding sea which bathes its shores. July and August are commonly the two warmest, and December and January the two coldest months of the year. The difference of temperature between England and Scotland, is chiefly observable with regard to the degree of heat in summer. According to Fahrenheit's thermometer, the mean annual temperature at London is about 51° 9′, the range of the annual variation being 61°, that is 31° 9′ below and 29° 1′ above the mean; leaving 20° for the lowest, and 81° for the highest degree of heat. At Edinburgh the annual mean is about 47½°, the lowest being seldom less than 20° and the highest seldom more than 75°, affording an annual range of 55°. In the vicinity of the former of these cities, the thermometer in June last (1817) stood in the shade at 84°, and in exposed situations at 113°; and in the neighbourhood of the latter at 82° in the shade, and at 107° in exposed situations. This is the greatest heat which has been known in Britain since 1808, when at London the thermometer rose nearly to 90°, and at Edinburgh to 82°.

More *rain* falls in the western than in the eastern parts of the island; and although it be impossible to ascertain precisely the real quantity which annually occurs, yet the indications of the rain-gauge kept at different places, may serve to give some idea of their relative moistness. At Liverpool the annual average is 34.4, at Keswick 68, at Kendal 64, near Leeds 27.5, and at London 23 inches; at Largs, near the mouth of the Clyde, 39.7, at Greenock 32.4, at Glasgow 28.3, at Edinburgh 25.3, but at the top of Nelson's monument only about 15.3, and at Gordon castle 25 inches. According to Sir John Sinclair's General Report of Scotland, the difference of fair weather throughout the year, in favour of the eastern coast, is seventy days.

The state of the barometer tends to confirm the above indications. From the greater humidity of the atmosphere the mercury usually stands lower at Kendal than at York or London, and lower at Greenock than at Edinburgh or Dalkeith. Its mean annual height in Britain is about 29.8; it seldom rises higher than 30.5, nor sinks lower than 28.5; having a range of about two inches. A drizzling *mist* sets in, and heavy *dews* begin to fall in spring; and evaporation, which is very considerable, is three times greater from the 21st of March to the 21st of September, than during the rest of the year.

In Britain the most prevalent *winds* are those from the west; and to this circumstance is to be ascribed the quantity of rain which deluges its western parts, where the mountains intercept the clouds charged with vapours from the Atlantic ocean, and nearly deprive them of their contents before they reach the east. At London the wind blows, on an average during the year, 215 days from the west, and 116 from the east; from the south 18, and from the north 16 days. It appears from 620 observations made in the vicinity of Edinburgh, that in the year ending 16th November 1816, the wind blew 185 days from the west, and 112 from the east; from the south 18, and from the north 26, with 25 days variable; and that from the 16th November 1816, to the 28th July 1817, the wind blew 165 days from the west, and 63 from the east, from the south 9, and from the north 3, with 14 days variable. The westerly winds are the highest, the most regular, and the most salubrious.

As to the electrical phenomena of the island, *thunder* and *lightning*, which seldom do much mischief, generally occur during the summer months, between May and September, although they sometimes happen even in December and January. Until the beginning of the 18th century the *aurora borealis* rarely appeared; and its brilliant and beautiful coruscations, which subsequently to that period had often excited attention, have since 1793 been less frequently observed.

Zoology.—According to Mr Pennant there are twenty genera of *animals* in Britain, besides those which are now extinct. The island, at an early period of its history, could enumerate among its quadrupeds, the buffalo, the bear, the wolf, and the wild boar; but these, since the woods in which they ranged have so generally yielded to the hand of cultivation, have long given place to others of a domestic and more useful kind. If we except the red deer and roe-buck, which still bound over the Highlands of Scotland, the wild quadrupeds which are at present to be found are of a less size; such as the fox, the badger, the martin, the otter, the hedgehog, the hare, the squirrel, the mole, the rat, and the mouse. The horse, undoubtedly the noblest animal over which man has extended his conquests, is met with in great perfection, and of different breeds. Oxen and sheep of various casts, and of every degree of excellence, graze on the richest pastures; but the indigenous horned-cattle, which are long-legged, of a pure white colour, with black muzzles, &c. exist only in Needwood forest in Staffordshire, at Chillingham castle in Northumberland, and in Hamilton wood in Lanarkshire. Of the hog, which forms a part of the stock of almost every farmer, and also of the domestic species of the dog kind, there are great varieties. The goat, an inhabitant of the rocks, is common in the mountainous districts; and the sea-calf and great seal are frequently to be seen on the surrounding coasts.

The *ornithology* of the island consists of 48 genera; of which the bustard is the largest, and the golden-crested wren the smallest bird. The nightingale, peculiar to England, is confined chiefly to the eastern and midland counties, and is seldom observed farther north than Doncaster, in the west riding of Yorkshire. All the domestic birds seem to be of a foreign origin; the poultry from Asia, the Guinea fowl from Africa, the peacock from India, and the pheasant from Colchis in Asiatic Turkey. There are four genera of reptiles; namely, the frog, the lizard, the serpent, and the snake. And, abstracting from those called crustaceous, there are 40 genera of fish. The whale sometimes appears in the circumambient sea, but the basking shark is often seen playing on the western coast. Some of the most excellent of the edible among the finny tribe, are the turbot, the salmon, the cod, the smelt, the mullet, and the skate.

Botany.—From the lofty pine, which waves in the forest, down to the humblest vegetable that creeps on the ground, the Flora of Britain is highly interesting to the botanist. It consists of about 2000 plants and the discoveries of every succeeding year are adding to their number. Of these, besides grasses, ferns, and sea-weeds, some are *leguminous*, some *umbelliferous*, some *bulbous*, some *rosaceous*, some *radiated*, some *evergreens*, and others *deciduous*. Most of them are common to England and Scotland, although each country contains a few peculiar to itself. But as our limits forbid us to enter at large into the subject, and as no useful purpose could be served by a partial or mutilated view of it, the reader who may wish a description of the generic and specific characters of our indigenous plants, is referred to Smith's *Flora Britannica*, or *Withering's Botanical Arrangement of British Plants*.

Mineralogy.—Great Britain presents a wide field of investigation to the mineralogist. All the varieties of primitive and secondary rocks are met with; coal, which gives life and vigour to her manufactures, is abundant in many places; and the more useful metallic ores may be enumerated among her mineral treasures.

Primitive rocks.—Granite is the common rock in Cornwall, is sparingly found in some of the interior districts of England, and occupies the central parts of some of the mountains of Scotland, as in Galloway, the Grampians in the north, and in the islands of Arran and Mull on the west. Gneiss, or schistose granite, is less frequent, but appears on the sides of the Grampians and in the islands of Coll and Tirie. Micaceous schistus is the prevailing rock on the flanks of the mountains in some of the islands of Scotland, as well as in some of the central regions; and common slate is abundant both in England, Scotland, and the islands. Scotland affords some varieties of primitive limestone, or marble, which are not destitute of beauty. Serpentine appears in Cornwall and at Portsoy, nearly at the extremities of the island. Porphyries of the primitive class are occasionally met with; syenite forms extensive beds in Islay and on the western coasts of Ross-shire; and quartz rock composes the central range of the mountains in Islay and Jura.

Secondary rocks.—Of the secondary rocks the grey wacken of the Germans occupies a great extent of the southern districts of Scotland; and it is not an uncommon rock in some of the northern parts. All the varieties of sandstone are common; gypsum, or plaster of Paris, is frequent in some parts of England, but rare in Scotland; and the extensive deposition of rock-salt in Cheshire has been long wrought. Chalk is abundant in England, but is unknown in Scotland. A range of chalk hills begins at Flamborough-head in Yorkshire, and runs in a westerly course for the distance of twenty miles; two ridges traverse the middle counties, and approach nearly to the borders of Oxfordshire; and on the south side of the Thames a ridge commences at the North and South Foreland, passes through Kent and Surrey, and terminates in Hampshire; and another ridge begins near the lofty promontory of Beachy-head, and passes through Sussex and the south of Hampshire into Dorsetshire.

Coal.—Coal is far from being universally distributed in Great Britain; two great belts of coal traverse the island from sea to sea. The first great belt, of which the Newcastle and Whitehaven coal-fields form the extremities, crosses the northern district of England; and the great belt of coal in Scotland occupies the vallies of the Forth and Clyde, and the adjoining districts. Beside these extensive depositions, coal is abundant in the counties of Stafford, Derby, Gloucester, and South Wales; and in Scotland, in small patches in the counties of Dumfries, Argyle, and Sutherland.

Metallic ores.—Great Britain furnishes some of the more useful metallic ores in great abundance. The search for gold, and the operation of separating it from the alluvial soil in which it was found, were carried on in the mining district of Leadhills in Scotland during the reign of Queen Elizabeth, and, it is supposed, by persons sent from England; they were resumed on a large scale at a much later period, but, excepting as an amusement, are now entirely discontinued. Excepting a few globules of native mercury, which were discovered in a bed of clay in digging the foundation of a house at Berwick-upon-Tweed, none of the ores of that metal has been found in Britain. Silver ores are rare in this country. Some of the lead ores afford a considerable proportion of silver; and the mines of Cornwall yield a small quantity of the native metal. From L.40,000 to L.50,000 worth of silver were obtained from a vein in the parish of Alva, in the county of Stirling in Scotland, before it was finally exhausted, but the researches made to recover it proved fruitless. Valuable copper mines have been long wrought in Cornwall, in Derbyshire, and in Wales; but although appearances of copper ores are not unfrequent in Scotland no productive mines have been opened up. Iron ores are abundant in many places; and lead mines have been long wrought in different places of England and Scotland. Tin has never been discovered in any part of Britain excepting in the mines of Cornwall, which were known from the earliest ages, and are still productive. The ores of zinc are common in some of the lead mines; and antimony has been met with in Cornwall and Devonshire; but the greatest repository of that metal is in Dumfries-shire. Cobalt is rare in Britain, but some of its ores have been found in considerable quantity in Cornwall, and in the copper mine of Alva in Stirlingshire in Scotland. The chief source of manganese, a valuable commodity in various manufactures, is in Devonshire; and a vein of the same metal was discovered some years ago in the primitive rocks of Aberdeenshire.

Chap IV. Soil and Agriculture.

In an extent of surface so great, and so diversified by hill and dale, as that of Britain, a variety of soil is naturally to be expected. Some tracts, accordingly, present clay and loam; others chalk and calcareous earth; and others gravel, sand, and moss. Good and productive soil is most prevalent in the southern, midland, and eastern counties. The proportion of waste to cultivated lands is greater in Scotland than in England and Wales, arising from the sterility of its numerous bleak and shelterless mountains, which must ever bid defiance to the efforts of human industry and improvement. Of the

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38,498,572 acres which the southern division of the island is computed to contain, about 7,787,000 are waste, and nearly 31,000,000 are either cultivated or planted with useful timber. The northern division, including its islands, is estimated at 19,352,320 acres, of which about 13,900,000 are waste, and 5,452,320 are either cultivated or covered with valuable wood.

The art of husbandry seems to have been first practised in the south-eastern corner of the island; but at what period it was formed into a regular system is not certainly known. During the Roman possession, as early as the third century, considerable progress in this art was made; woods were hewn down, and marshes were drained. From that era agricultural improvements have advanced, sometimes with slower, and at others with more rapid steps, to its present state. These improvements have been promoted by the exertions of several distinguished proprietors, the writings of different individuals of great professional eminence, and the zeal and encouragement of the British Board of Agriculture. The value of the whole land produce of England, according to Mr Arthur Young, in his Agricultural Report of Essex, is L.145,800,000,—and of Scotland, according to Sir John Sinclair, in his General Report, L.23,261,155, making a total for Britain of L.169,061,155. In no country of the world is agriculture carried to greater perfection; the preparation of the ground, the rotation of the crops, and the mode of conducting every branch of rural economy are well understood. See Agriculture.

The *horticulture* of the island is not inferior to its agriculture. By this art in the raising of culinary vegetables, the rich and delicate fruits of more southern latitudes, and other productions of the garden, the defects of the climate are in some degree compensated, and the tables of the wealthy are loaded with luxuries.

Chap. V. Inhabitants.

Respecting the first inhabitants of Great Britain, the most probable opinion is, that they migrated from Gaul, at an early period, when but one race of men existed in western Europe. And, indeed, the declarations of Cæsar and Tacitus as to the identity of the people of those two countries, tend powerfully to confirm this opinion. The Celtic tribes, who settled on the southern shores, would gradually move northward, as they were prompted by curiosity or by interest, until they at length diffused their population over the whole island. Accordingly, we find that the same worship, and manners, and language, prevailed in both of its local divisions; and these furnish proofs, " which," says Mr Chalmers in his Caledonia, " demonstrate the sameness of the people with greater conviction than the fanciful theories of philosophers, or the absurder intimations of ignorant chroniclers."

Present state.—But by foreign intermixture the inhabitants, if we except the Welsh and the Scotch Highlanders, who still retain their original characteristics, soon lost their national and distinctive features. To their Celtic blood was added an infusion from that of their Roman, Saxon, Danish, and Norman invaders; and in later times the confusion of races has been considerably increased by an influx of strangers from different countries, impelled thither by the motives of safety, commerce, or employment. Hence it is, that while the language which is now spoken has for its basis a dialect of the Teutonic tongue, it is much indebted for the copiousness which it displays to most of the other languages of Europe, from which it has so liberally borrowed its treasures.

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Character.—The British, generally considered, are well made, brave, and generous. They are inclined rather to be taciturn than loquacious; and although impatient of controul or of insult, they are far from being implacable when offended. No people rank higher in a moral and intellectual point of view, or evince greater vigour of mind, and observe more correctness and integrity in their conduct. If their imagination be not so sprightly and luxuriant as that of their neighbours, who enjoy a purer and serener atmosphere, their judgment is at least more solid, and their ratiocinations more profound. In the departments of history and of metaphysics they stand unrivalled.

Number.—The population of Great Britain has since the Revolution been gradually increasing, as will appear from the following statement:

England in	1688 contained	6,500,000 inhabitants.
	1786	8,000,000
	1801	8,872,980
	1811	10,106,780
Scotland in	1755	1,266,380
	1799	1,526,492
	1801	1,599,068
	1811	1,804,864

Thus, according to the last return, the population of the whole island is 11,911,644; and if to this number we add 640,500 for the army, navy, &c. the aggregate sum will be 12,552,144, or somewhat less than one person for every four acres.

Chap. VI. Manufactures, Commerce, Revenue, &c.

Great Britain, in respect of the excellence of her manufactures, the extent of her commerce, and the magnitude of her revenue, surpasses every other country in Europe, if not in the world.

Manufactures.—In consequence of the division of labour, the application of improved machinery, and other contributory causes, the manufactures have arrived at great perfection. Woollen cloths and kerseymeres of the finest quality are made in different counties of England, such as Wilts, Somerset, and York; and stuffs of various kinds are fabricated in Norfolk, Suffolk, Essex, Leicester, Nottingham, Montgomery, and Denbigh, and in some places of Scotland, especially the shires of Selkirk and Stirling.

The *cotton* manufacture, which is of more recent origin, is now carried on very extensively in different districts of the country. Its principal seats are, Stockport, Manchester, Bradford, Carlisle, Glasgow, and Paisley. To facilitate the process of weaving, and to improve the quality of the texture, many ingenious mechanical inventions have been employed; and, in respect of variety and elegance, there is no sort of goods in which the superiority of the British fabric is more apparent and generally acknowledged. *Linen*, of various descriptions, is wrought in Scotland and the north of England; and the manufacture of silk, begun about the middle of the 15th century, and afterwards greatly promoted by the French refugees in 1685, is very considerable at Spitalfields, Coventry, Leek, Ockingham, and other towns in South Britain.

In point of excellence, the different branches of *metallic* manufacture cannot be surpassed. At London and Edinburgh, especially the former, the most accurate and finished mathematical and optical instruments are executed; besides a variety of workmanship in gold, silver, and jewellery. Locks, hinges, polished steel, cutlery, plated goods, and different kinds of tools, unrivalled for their beauty and their cheapness, are produced at Birmingham and Sheffield. Porcelain, of the finest patterns and in the most exquisite taste, is made at Worcester, Derby, and Colebrookdale; and potteries of earthen ware are common throughout the island, although the preference is generally given to the ware of Staffordshire. In addition to those now enumerated, there are many other manufactures, such as glass, paper, hats, leather, gunpowder, copperas, white-lead, soap, and turpentine.

Commerce.—Great Britain, from the excellence of her manufactures, the advantages of her insular situation, and her ascendancy in the scale of nations, is well fitted for carrying on an extensive trade. Claiming the dominion of the ocean, she spreads her ships over its surface, and, possessing almost universal commercial relations, lades them with the riches of the world. On the 30th September 1813, her merchant-vessels were 19,315 in number; of which 16,602 belonged to England, and 2713 to Scotland, bearing, in all, 2,260,910 tons, and manned with 144,673 seamen, including boys. To give some idea of her traffic, a table is here subjoined, shewing the official value of her exports at different periods, and distinguishing her own produce and manufactures from her foreign and colonial merchandise.

Year.	British.	Foreign.	Total Exports.
1792...	L.18,336,851	L.6,129,998	L.24,466,849
1796...	19,102,220	8,923,848	28,026,068
1800...	24,304,283	13,815,837	38,120,120
1804...	23,935,793	10,515,574	34,451,367
1808...	26,691,962	7,862,305	34,554,267
1815...	44,053,455	16,930,439	60,985,894
1816...	36,714,534	14,545,933	51,260,467

From the numerous regions to which Great Britain extends her commerce, she imports goods of various descriptions; and, on an average of many years, the balance of trade has been very considerably in her favour.

Her principal imports from the continent of Europe are, hides, furs, silks, cambrics, wool, carpets, flax, tallow, bar-iron, tar, pearl and pot-ashes, drugs, gums, dye-stuffs, corn, cheese, butter, fruits, wines, geneva and brandy;—from Asia, tea, spices, opium, drugs, gums, saltpetre, quicksilver, raw silk, cotton, and various products of the loom;—from Africa gold-dust, gums, and ivory;—from North and South America, flour, rice, tobacco, timber, indigo, and furs;—and from the West Indies, sugar, rum, coffee, pepper, ginger, drugs, cotton, and mahogany.

Revenue.—The chief sources from which the revenue of Great Britain is derived are two, the Permanent and War Taxes. To the first of these belong the duties of customs and excise, the stamp-duties, the post-office duties, the land and assessed taxes, and some miscellaneous taxes; and to the latter are referred those occasional taxes which are rendered necessary by extensive and protracted hostilities, as, for instance, the property-tax, imposed during the late struggle with revolutionary France. With the growing prosperity and demands of the country, the annual revenue, arising from these different branches, has likewise increased,—as will appear from the following statement:

Year.	Net revenue.
1812...............	L.60,866,652
1813...............	63,763,864
1814...............	65,429,981
1815...............	66,443,802
1816...............	57,360,694

When the public income is too small to support the public expenditure, extraordinary grants, called aids, subsidies, or supplies, are usually voted. Out of the revenue resulting from the permanent taxes, the interest of the national debt is discharged; a debt which, since its commencement with L.5,000,000 in 1697, was, in 1816, about L.800,000,000. To pay it off, a sinking fund, planned by Mr Pitt, was instituted in 1786.

Army and Navy.—In the year 1801, Great Britain maintained 149,865 regular troops; and in 1814, which witnessed the first promise of the liberation of Europe from French tyranny and oppression, upwards of 247,500 troops, including cavalry, foot-guards, infantry, and militia. But since the decisive victory at Waterloo in 1815, their numbers, which have been much reduced, are not so easily ascertained; although, on a rough guess, they may be stated at about 110,000. The Navy, which has long been the glory and the bulwark of the nation, amounted in 1784 to 496 ships; in 1801 to 787; in 1814 to 1022; and in the present year, 1817, to 503, of which 151 are of the line.

Chap. VII.—Civil and Ecclesiastical Constitutions.

It has been observed by the Abbe de Condillac, that "Every state is more or less happy in proportion as its laws approximate to the impartiality of nature." This remark, when applied to Great Britain, points out the excellence of her civil and ecclesiastical constitution, which, being founded on principles of justice and of freedom, regards, with as jealous an eye, the rights of the lowest as the highest of its subjects, and procures for all, over whom it extends its authority, a greater sum of prosperity and happiness than perhaps that of any other nation.

Civil Constitution.—In 1603 both kingdoms became subject to the sway of one sovereign; but it was not until 1707, that the Scottish was merged in the English legislature. Of these kingdoms thus united, the government, which has long excited the admiration and the envy of foreigners, is of a mixed character, being composed of three branches, the King, the Lords, and the Commons. Each of these branches operates as a check upon the other, and prevents all encroachments on the constitutional rights of the nation. With the King, whose crown is hereditary, and whose person is held sacred, the executive power is lodged. His are the prerogatives of making peace and declaring war; of sending and receiving ambassadors; of forming treaties and alliances; of levying armies and fitting out fleets; of disposing of all magazines, castles, forts, havens, and ships of war; of nominating all the great officers of the state and of the household; of summoning, adjourning, proroguing, and dissolving Parliament; of confirming or rejecting any bill to which his sanction is requested; of conferring all titles of rank and honour; of pardoning criminals, or mitigating their punishment; and of managing the coinage, and determining its alloy, its weight, and its value.

The Lords and the Commons, convoked by writs from the King, to deliberate on the affairs of the state, compose the national Parliament, which is divided into what is called the Upper and the Lower Houses. The nobility, who occupy the Upper House, are distinguished into the Lords Spiritual and Temporal; the former consisting of two archbishops, and twenty-eight bishops; and the latter, of those who are peers by descent, by creation, or by election. In the Lower House sit the Commons, of whom there are 658, elected from among the knights, the citizens, and the burgesses, respectively representing counties, cities, and burghs.

The House of Lords is the highest court of justice in the realm, and from its decisions there is no appeal. The House of Commons is the grand inquest of the nation, and with it all grants of subsidies, and all bills, which more immediately affect the interests of the people, must originate. Freedom of speech, and protection from all arrests, except for treason, felony, or the publishing of seditious libels, are among the peculiar privileges common to both houses of Parliament.

In all essential points, the present constitution of Parliament was marked out, as early as the reign of King John, in the great charter of their privileges which his barons compelled him to sign in the year 1215. The Lords and the Commons originally met in the same place; but at what particular period the separation of the one from the other was effected is uncertain. Every act must first be presented in the shape of a bill, which after passing, in due form, through both houses, and receiving the sanction of the crown, is converted into a law. It would be entering on too wide a field, to describe here the character and functions of the different offices of state, or of the different courts of justice. Some account of these will be found under their proper titles.

Ecclesiastical Constitution.—In South Britain, the established form of ecclesiastical government is diocesan Episcopacy; the mode of worship is liturgic; and the creed, as unfolded in the thirty-nine articles, embraces the doctrines of the Calvinistic system. The King who, since the time of Henry the VIII. has been styled the head of the church, nominates to the vacancies in all episcopal sees. Properly speaking, there are only three orders among the clergy, namely, bishops, priests, and deacons; but the titles of archbishop, dean, prebendary, canon, &c. are also acknowledged. There are two archbishops, those of Canterbury and York, the former of whom is the primate of all England, the first peer in the realm, and next to the royal family; and there are twenty-four bishops, who enjoy the privilege of peers, besides the bishop of Sodor and Man, who has no seat in the House of Lords. Among the church courts are the convocation, now merely nominal, the court of delegates, the court of arches, and the court of audience. In all there are 1881 parishes, 2533 churches and chapels, and, it may be added, 3,438 dissenting places of worship. The average livings, taking in the higher and lower clergy, are about L280 annually.

Since the revolution in 1688, the Presbyterian form of church government has been established in North Britain. In this division of ecclesiastical polity, the most distinguishing principles are parity among the clergy, and the absence of all prescribed forms. The creed, as embodied in the confession of faith, and larger and shorter catechisms, is purely Calvinistic. Church sessions, presbyteries, provincial synods, and the general assembly, are the order of the ecclesiastical courts, proceeding from the lowest to the highest. There are 893 parishes, and 928 churches and chapels on the establishment, to which belong 1,408,388 individuals; and there are 397,300 dissenters of different denominations. The average livings are about L.200 annually, without allowing for manse and glebe.

The reader who wishes to pursue the preceding subjects farther, may consult Pinkerton's and Playfair's *Systems of Geography;* Aikin's *Geographical Delineations*; Chalmers' *Caledonia*, and his *Domestic Economy of Great Britain and Ireland*; Campbell's *Survey of Great Britain*; Wedderburn's *View of England;* and Sir John Sinclair's *Statistical Account*, and his *General Report of Scotland.*

PART II. CIVIL HISTORY.

In the following sketch of the history of Great Britain it is proposed, *1st*, To take a view of the history of England from the earliest times to the union of the crowns of England and Scotland; *2d*, Of the history of Scotland preceding the same era; and *3d*, The history of Britain from the union of the crowns to the present times, forming three separate chapters.

Chap. I. History of England.

Fabulous accounts.—The early history of this country, as of most other nations, is obscure, unauthentic, and, it might be added, uninteresting, if this did not impeach the judgment of our great dramatist, to whom it furnished materials for one of the finest exertions of his muse, and if the example of another poet, of no less splendid fame, did not assign a reason and an apology for avoiding such an imputation. Speaking of the generally, but not universally distrusted, relations respecting the most ancient affairs of the island, Milton does not hesitate to declare both his intention and his inducement to repeat them. "Seeing, (says he,) that oftimes relations heretofore accounted fabulous, have been after found to contain in them many footsteps and reliques of something true, as what we read in poets of the flood and giants, little believed, till undoubted witnesses taught us that all was not feigned; I have therefore determined to bestow the telling over even of these reputed tales, be it for nothing else but in favour of our English poets and historians, who by their art will know how to use them judiciously." To these, indeed, and to all "fables which are commonly employed to supply the place of true history," the authority of Hume prescribes an entire disregard; but the terms of his interdict, it will be seen, imply an assumption, not altogether warranted by the circumstances of the case,—that falsehood is substituted for truth; and, besides, he himself admits an exception in favour of the ancient Grecian fictions, for a reason that is totally destructive of the principle contended for—their being so *celebrated* and so *agreeable*, "that they will ever be the object of the attention of mankind." In place of such partiality and such indifference, on the mere ground of more or less pleasure from their perusal, it is an essential duty of the historian to rescue and to sustain what is probable, though it be neither certainly true nor yet agreeable and celebrated, from the contaminating mass of obvious absurdities and unaccredited legends. With this intention, therefore, a brief recapitulation of some "reputed tales" is now offered to the reader's attention. They are assuredly not employed to supply the place of true history, for nothing deserving that title exists, respecting this period, to be injured by so humiliating a preference; and though not, perhaps, equal to Grecian fictions, they have nevertheless a connection with the sentiments and the literature of our ancestors, which ought at least to exempt them from annihilation.

Samothes, Albion, &c.—The vanity of some of their own writers, anxious for the imaginary honour which antiquity confers, availed itself of unworthy and fictitious authors to carry back the establishment of the original inhabitants of England to a Samothes, or Dis, a fourth or sixth son of Japheth, whom they assert to have planted colonies about 200 years after the flood, first in Celtica, or Gaul, and afterwards in this island, thence named Samothea, where he reigned, and from whom descended four kings, Magus, Saron, Druis, and Bardus. Nothing but the most determined credulity could have listened to a fabrication so totally unfounded and so improbable. A branch of this story bears, that the inhabitants of Samothea were subdued in the reign of Bardus by Albion, a giant, and son of Neptune, who gave the island his own name, and ruled in it for forty-four years, when, having gone over to Gaul to assist his brother Lestrygon, whom Hercules was hastening out of Spain to attack, he was slain in battle.

In part of this, properly interpreted, there is a shadow of meaning not unworthy of regard, though too general in its import to satisfy national partiality,—that a navigator and a man of power, so named, having visited the island some time after it had been peopled, made a settlement in it, and obtained authority among the former inhabitants. Certain it is, that both Greeks and Romans anciently styled the island Albion; and that some authors make mention of a place between Arles and Marseilles, in France, where the chief so named, and his brother Bergion, or, as others have it, Dercynus, lost their lives in a contest with Hercules, and to which, from the circumstance, as it is related, of this semi-deity being favoured with a shower of stones during the battle, but rather owing to its abounding in rocks, the epithet of *stony*, or, in the Celtic tongue, the title of the *crag*, or *craig*, was afterwards applied.

Dioclesian's daughters.—"Too unconscionably gross," to use the language of Milton, is another and a fond invention, that "wafted hither the fifty daughters of a strange Dioclesian king of Syria." This is a patriotic, but very unwise adaptation of the well known, though totally apocryphal story of Danaus, king of Argos, and, like it, does equal injustice to the fair sex. The whole number of the ladies, with the exception of one, it is vilely reported, murdered their husbands on the night of their marriage,—a summary cruelty, which no doubt richly deserved their being "turned out to sea in a ship *unmanned*," as the poet has it, "of which whole sex they had incurred the hate." Fortune, or the fates, according to the story, drove them to this island, "where the inhabitants, none but devils, as some write, or, as others, a lawless crew left here by Albion, without head or governor, both entertained them and had issue by them, a second breed of giants, who tyrannised the isle till Brutus came." From the eldest of these nefarious damsels, called Albina, says the legend, the name of Albion was derived.

Story of Brutus.—"Hitherto the things themselves have given us a warrantable dispatch to run them soon over." The attempt to obtain a Trojan origin for our ancestors, so that in one thing, at least, we might resemble the Romans, unlikely and unsuccessful as it may have been, has had too many admirers, and is too seducing to common minds, to be so readily discharged. Whether certain or uncertain, such a report, if it "keep aloof from impossible and absurd, and be "attested by ancient writers, from books more ancient," is not to be refused "as the due and proper subject of story." The authors who have chiefly mentioned it are Geoffry of Monmouth, Henry of Huntingdon, and Matthew of Westminster.

Brutus, son of Sylvius, the grandson of Eneas, whose piety and wanderings are blazoned by the prince of Latin poets, having the misfortune, according to prophetic intimation, to occasion the death of both his parents, some time after the establishment of the Trojans in Italy, was induced, at the instigation, or by the dread of his kindred, to retire into Greece. Here he met with some of the descendants of Helenus, son of Priam, in a state of slavery under king Pandrasus. Ingratiating himself with them, and obtaining their confidence, he is induced to become their leader in an attempt to recover freedom, which having accomplished, after various difficulties, the display of courage and subtlety, and acquiring the king's eldest daughter, Innogene, in marriage, he sets sail with the Trojans in a fleet of 324 vessels. A voyage of two days and a night brings them to a certain island, named Leogecia, now unknown, and at that time dispeopled and laid waste. Here a temple and image of Diana being discovered, it was determined that Brutus should solicit an oracular response as to the future course to be pursued. The goddess, propitious to his wishes, answered him in a vision:

"Brutus, far to the west, in th' ocean wide,
Beyond the realm of Gaul, a land there lies;
Seagirt it lies, where giants dwelt of old,
Now void, it fits thy people; thither bend
Thy course, there shalt thou find a lasting seat;
There to thy sons another Troy shall rise,
And kings be born of thee, whose dreaded might
Shall awe the world, and conquer nations bold."

Thus encouraged, Brutus again sets sail in the direction suggested. During his course, he arrives at a place in the Tyrrhene sea, where he finds the offspring of those of his ancestors who had come into Italy with Antenor. These, under Corineus, join him. He now passes the straits of Hercules, and casts anchor on the coast of Aquitania in Gaul, where he sustained considerable loss in several engagements with king Goffarius, particularly that of his nephew Turon, from whom the city of Tours had its name. This calamity, and his recollection of the oracle, induce him to leave the country; and, accordingly, prosecuting his voyage, after an easy course, he arrives at the promised island, near the spot where the town of Totness now stands, in the county of Devon. The only remaining inhabitants, at this period, were some giants of the race of Cham, who of course are slain, after which Brutus divides the country among his followers. He himself reigned over the whole island for twenty-four years, when he died, and was buried in the city which he had founded, Troja Nova, afterwards denominated Trinovantum, and now London, having bequeathed his dominions to his three sons, viz. Loegria, the same as modern England, exclusive of Wales, to Locrin, or Loegrin, his eldest; Cambria, or Wales, to Camber, whose name it inherited; and Albania, since called Scotland, to Albanact, the youngest. These events are related to have occurred about 1200 years after the flood, and upwards of half a century from the destruction of Troy.

Locrine,—in whose fortunes we are most concerned, though contracted in marriage to Guendolen, daughter of Corineus, long held illicit commerce with Estrildes, the daughter of a king of Germany, remarkable for her beauty, and whom he had made captive in an engagement with Humber, king of the Hunds. On the death of Corineus, whose authority he feared, Locrine divorces Guendolen, and proclaims Estrildes queen. The former flying into Cornwall, where her son, Madan, had been brought up by his grandfather, gathers her fathers friends and subjects, with whom she makes war on Locrine, gives him battle, in which he loses his life, and following up her success and revenge, throws both Estrildes and a daughter whom she had born to him into a river, which thence took the name of the latter, Sabra, but was afterwards changed to Sabrina, or Severn.

Madan, Ebranc, &c.—After a reign of fifteen years, Guendolen resigned in favour of her son Madan, who ruled prosperously and in peace for forty years, and left two sons, Mempricius and Malim, by no means so fortunate. The former dreading the ambition of his brother, treacherously slew him, but afterwards reigned ingloriously, and was at last devoured by wolves. His son, Ebranc, succeeded, and reigned forty years in no small splendour. He is said to have carried on a predatory war in Gaul, and, after his return with great riches, to have laid the foundation of two celebrated cities, Caerebranc, now York in England, and Alclud, Mount Agned, or the Castle of Maidens, the ancient title of the metropolis of Scotland. After him, in succession, reigned a second Brutus, who carried on his father's wars abroad; Leil, a peaceable man, whose latter years were troubled with civil discord; Rudhuddibras, or Hudibras, the alleged founder of Caerkeynt, now Canterbury, Caerguent, now Winchester, and Mount Paladur, now Septonia, or Shaftesbury, as his father was of Cairleil, now Carlisle; and Bladud, an ingenious and skilful man, who is said to have built Caerbadus, now Bath, and to have dedicated its medicinal waters, already celebrated, to the goddess Minerva.

King Lear's fortunes, &c.—Then succeeded Leir, or Lear, part of whose eventful history is immortalized by the genius of Shakespeare. This amiable but imprudent man, feeling the infirmities of age creep upon him, and having no son, resolves to divide his kingdom among his three daughters, not indeed equally, but with some respect to the largeness of their professed affections towards him, as ascertained by simply questioning them in order. In this foolish trial, the sincere but unostentatious regard of the youngest, Cordellia, previously his favourite, and from whom he expected the most zealous declaration, excites his indignation, in consequence of which he disinherits her, sends her into banishment, and having given the other two daughters in marriage to Maglaunus, duke of Albania, and Henninus, duke of Cornwall, divides between them one half of his territories, promising the remainder at his death. Their piety, little promoted by their pompous flattery, does not prevent them from encroaching on his authority, and at last depriving him of every portion of his kingdom. Repeated indignities and acts of aggravated cruelty, apparently concerted to drive him to despair and death, at last convince him of the injustice and folly of his decision. Then the remembrance of his youngest child, whose candour and good sense he had despised, awakens a ray of hope, mortifying as it was, that her love towards him "being what her duty bade," might form as great a contrast to that of her sisters, as her modesty did to their fulsome protestations. The far-famed wisdom and graces of this excellent lady had ere now obtained for her the esteem and the hand of a great king in Gaul, whither, Lear, overwhelmed with distress, takes his journey. He is received in a manner fitting his misfortunes and her own character; and such is the regard and the confidence of her husband, that an army is immedidiately appointed to aid in recovering his throne. Their enterprise is fortunate; Lear reigns again for three years, and is succeeded by Cordellia in her own right for five years, when she is deposed and imprisoned by Marganus and Cunedagius, her sister's sons. These part the land between them, but soon quarrel. A battle ensues, in which the former perishes. Cunedagius now reigns alone for many years, about the time when Rome was built. His son succeeds him; and the line of Brutus is carried on for several generations without any very remarkable occurrence.

Contest of Belinus and Brennus.—On the extinction of this race, the land is rent into five kingdoms, which continue at war with each other for about fifty years, but is at last reduced under one head by Dunwallo Molmutius, son of Cloten, king of Cornwall, and the first person who is said to have worn a crown of gold in the island. He is said to have established a system of laws long after famous, and, in a reign of about forty years, to have given a degree of civilization and improvement to his country which it had never previously known. His two sons, Belinus and Brennus, after a contest for the crown, agree to a mutual participation of the land, vesting, however, the sovereignty in the elder. But this last concession soon proves disgusting to Brennus, who accordingly goes to Norway, where he forms an alliance with king Elsing, and obtains a fleet to support his ambitious pretensions. This was attacked on its way to Britain, by Guithlac, a Danish king, actuated by motives of jealousy, and a wish to obtain the wife of Brennus. The battle appears to have been disastrous to both parties, the fleet of Brennus being scattered, and the Danish king, after having got possession of his lady, being driven on the coast of Northumberland, where he is made prisoner, and whence, together with her, he is brought to Belinus. Collecting again his navy, Brennus resumes his enterprise, lands in Scotland, gives battle to his brother, is completely defeated, and obliged, with one ship, to flee into Gaul, where, in course of time, he acquires the friendship of Saginus, duke of the Allobroges, whose daughter he marries, and to whose dominions he latterly falls heir. By this success, and through the aid of several kings of Gaul, he thinks himself more able than ever to gain a settlement in his native country, now peaceably and wisely governed by his brother. With great force, therefore, he lands in Britain, and finding Belinus totally unprepared, promises himself certain victory, when, on the very eve of battle, his aged mother, Conuvenna, appears on the field, throws herself between the two brothers, and by the most forcible appeals to affection, duty, and respect, accomplishes an entire reconciliation.

Barbirus said to have peopled Ireland.—Now joining hands and forces together, Belinus and Brennus prepare for foreign conquests. In a little time they over-run most of Gaul, and actually push into Italy, where they give no small annoyance to the Roman state. Belinus at last returns home, reigns in peace and honour, builds various cities, beautifies the metropolis with a gate, a haven, and a tower, and devolves a flourishing kingdom on his son Gurguntius Barbirus. This prince, though mild and just, inherited his father's courage. He vanquished the Dane, whom Belinus had liberated on condition of becoming tributary, but who had violated his engagement. An event of still greater consequence, imputed to him, was the peopling of Ireland, which he is said to have effected by sending over some of his subjects with a colony from Spain, which he happened to find on board a fleet at the Orkneys, on his return from this successful war. They were led by Bartholinus, unjustly banished his country, as he alleged, and who now sought an asylum in the king's dominions.

Martia enacts laws. Morindus, &c.—Some useful laws are said to have been instituted in the reign of his son Guitheline, aided by the queen-mother Martia, whose wisdom is much extolled, and to whom in reality they have been ascribed. It is a little curious, and worthy of remark, that Milton, in relating this, is anxious to deprive her of such an honour, excepting in so far as she was guided by sage counsellors of the other sex, asserting, in his nervous but uncourtly style, that there can be "nothing more awry from the law of God and nature, than that a woman should give laws to men." During the reign of the third or fourth descendant of this legislatrix, as she may be called in spite of such authority, a king of the Morines, or Picards, is reported to have invaded Northumberland, but with no success, the British monarch Morindus, a man of uncommon strength and bravery, having overthrown his army,—a victory which he dishonoured by the inhuman slaughter of all the prisoners. This prince is said to have perished in a singular manner, being devoured by a monstrous creature which had arisen from the Irish sea, and infested the neighbouring coast, and which, confiding in his personal ability, he had ventured to encounter.

Generosity of Elidure, &c.—Gorbonian, the eldest of his five sons, is highly extolled for his piety, wisdom, and affectionate regard for the welfare of his subjects. He was succeeded by his brother Archigallo, not by any means equally praised. Being deposed from the government, the next brother, Elidure, of promising character, was called to the throne. The romantic behaviour of this prince, surnamed the pious, merits distinguished notice. After a conciliatory and equitable reign of five years, as he was one day hunting, he happened to meet his deposed brother in a very mean condition, immediately on returning from abroad, where he had long vainly solicited aid to effect his restoration, and now so much humbled as to be obliged to beg subsistence among any secret friends at home. Elidure affectionately embraces him, welcomes him to his native land, and immediately contrives means to prove the sincerity of his brotherly regard. Having concealed the wanderer in his own bed-chamber, he feigns himself so unwell as to require the assistance of his peers, in order to determine on a successor to the throne, in all likelihood soon to be vacant. These he admits to his counsel one by one, as if his weakness could not endure the fatigue of more at a time, and induces, each in his turn, to swear allegiance once more to Archigallo, whom, after reconciliation on all sides, he conducts to York and has immediately crowned. Such generosity was not unrewarded by the subse-

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quent behaviour of the prince, so unexpectedly restored to empire. The heroic deed seems to have wrought his conversion, and promoted a worthy reign of ten years duration. On his death, Elidure reassumes the government, but soon finds occasion to put his virtue to the test,—his younger brethren, Vigenius and Peredure, not won by such excellence, rebelling against him, and that indeed with too much success. After defeating him, and making him prisoner in the Tower of Trinovant (London,) they divide his kingdom, Vigenius taking the south and Peredure the north. On the death of the former, the whole fell into the hands of Peredure, whose government, notwithstanding the means by which it was acquired, deserved commendation. He, too, dying, Elidure, after many years confinement, is again seated on the throne, which he continued to fill in tranquillity, and with exemplary mildness, till his decease.

Long series of uninteresting reigns.—To these five brethren, succeeded several of their sons in order; at last the son of Elidure reigns, and gives rise to a race which is prolonged for many generations, but with few, if any, remarkable peculiarities, till we arrive at Blegabedrus, who is reported to have excelled all before him in the art of music, " opportunely, says Milton, had he but left us one song of his twenty predecessors' doings." Then comes a series of nine kings, equally mute and insignificant, or equally unfortunate in want of historians, the last of them alone, Cliguellius, having an addition to his name of modest, wise, and good. Heli, son of this commendable personage, after reigning forty years, left three sons, Lud, Cassibelan, and Nennius. The first of these, a hardy soldier, and a noble feaster, conquered many islands of the sea, says one of the historians, and was buried in the city henceforth called after him Caerlud, or Lud's town, now London, by the gate still bearing his name, viz. Ludgate. The two sons of this prince, committed to the tuition of his brother Cassibelan, were so far favoured by him, as to have portions of territory consigned them, viz. London with Kent on Androgeus, and Cornwall on Tenuantius; Cassibelan himself, whose liberality and behaviour had won the affections of the people, retaining sovereign power till the arrival of the Romans in the island.

Probable origin and early history.—The only inference which it may be safe to deduce from the preceding relation, is, that long before the event now alluded to, this island had undergone a great variety of revolutions, and that its inhabitants were accustomed, on various accounts, to carry on an intercourse with several parts of the continent. It is the probable opinion of some authors, that it was originally peopled from that portion of Gaul which corresponds with the opposite shores of Flanders and France. Hence the term Gael or Guydel, as the Welsh denominate their Celtic predecessors in the country, by way of distinction from their own ancestors the Cumri, Cymri, or Cimbri, who acquired it either by conquest, or, which is more likely, after the departure of the former for Ireland, which seems to have been peopled by them, and from which a branch of the same stock latterly found their way into the Highlands of Scotland. To the Celtic, it is said, succeeded a Gothic race in England, a branch of the Scythians, which, in its career from Asia, drove the Cimbri from their abodes, and under the name of Belgæ obtained a settlement in that part of Gaul which is nearest Britain, long antecedent to the Christian era. The Phenicians are understood to have early carried on a commercial intercourse with this island, and to have called it Baratanac, whence Britain, perhaps, signifying *land of tin*, a metal in which some parts of it abounded.

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Arrival of the Romans in 55, B. C.—Animated by his success in Gaul, and incited by its reputed wealth, as well as a desire to chastise its inhabitants for their repeated services to certain of his enemies, Julius Cæsar determined on visiting, and, if possible, subduing Britain, known to him already by frequent but not perfectly correct report. As he was little acquainted with the extent and nature of the country, and was more particularly uninformed as to the number and security of its harbours, he dispatched Volusenus, one of his officers, to view the coast, and in the meanwhile advances his troops to the place of embarkation. The Britons, soon apprised of his purpose, sent ambassadors with offers of obedience to the Romans, and hostages in pledge of their sincerity. These were civilly received, but did not accomplish the object of their mission, which was to prevent the meditated invasion. Volusenus having now returned, the general embarked his troops, and speedily got in sight of the British coast, probably near the cliffs of Dover, on which the islanders had assembled themselves in great force. Shortly afterwards he landed, as is imagined, near Deal, but not without a resistance in which he could easily discern their valorous and obstinate disposition. His troops, for some time almost panic struck, and repeatedly thrown into disorder, gradually, but with difficulty, obtained some advantage, on which they so far improved as at last to put the Britons to rout, though they were unable, from want of horse, to pursue them. The Britons, thus worsted, send ambassadors to sue for peace, which is granted on certain conditions, and the delivery of hostages. But a violent storm which soon afterwards came on, having dispersed or injured the greater part of the Roman fleet, they were induced, by the hope it afforded of expelling or destroying their invaders, to recommence their hostilities. They were again unsuccessful, notwithstanding a mode and a spirit of fighting which threatened the extermination of the enemy. Another proposal for peace was scarcely less necessary for Cæsar than for those who made it. He insisted only on doubling the number of hostages; and finding the season advanced so far as to render farther stay in the island injudicious and unsafe, immediately afterwards set sail for Gaul.

Cæsar's second visit.—Having prepared a larger and better-fitted army, Cæsar returned in the following summer; and landing at a place formerly marked by him, immediately after fortifying a camp, according to the Roman custom, proceeded with part of his troops in search of the Britons, who, intimidated at the vast display of force brought against them, had hitherto given no opposition, but waited in anxiety for a suitable opportunity to attack with advantage, or resist with effect. They were united under Cassibelan, king of the Trinobantes, who had previously carried on almost perpetual wars with his neighbours, but whom they found it convenient to appoint commander-in-chief. After various encounters, in which the Romans suffered severe losses, and had reason to put in full force their military virtues, these brave islanders were completely defeated. Farther resistance was attempted, but proved in vain. In the issue, Cassibelan solicited peace, which Cæsar more readily granted, as it was again necessary for him to retire to the continent.

Such is the substance of this able general's own statement of his expeditions into Britain; in considering which with attention, and every allowance for both his modesty and his virtual self-commendation, more especially when compared with the reports of other writers, and paying due regard also to the little immediate fruits of any claimed victory, it seems fair to conclude that he was very far from being fortunate in the enterprise. To his spirited and intelligent Commentary, nevertheless, posterity is indebted for something like authentic information respecting the early, though, probably, not the original inhabitants of this island.

Milton's summary description of the inhabitants.—The sentence, in which our illustrious poet has summed up the particulars of his intelligence, aided by remarks from other authors, is an instance of condensation of matter perhaps unexampled in any writer but himself. With very little modification, it is here inserted, in place of any more lengthened, but very probably less satisfactory observations on the various subjects to which it relates. "At Cæsar's coming hither, such likeliest were the Britons, as the writers of those times, and their own actions represent them,—in courage and warlike readiness, to take advantage by ambush or sudden onset, not inferior to the Romans, nor Cassibelan to Cæsar,—in weapons, arms, and the skill of encamping, embattling, fortifying, over-matched; their weapons were a short spear and a light target, a sword also by their side; their fight, sometimes in chariots, fanged at the axle with iron-scythes; their bodies most part naked, only painted with woad in sundry figures, to seem terrible, as they thought; but if pursued by enemies, not nice of their painting, to run into bogs up to the neck, and there to stay many days, holding a certain morsel in their mouths, no bigger than a bean, to suffice hunger: Their towns and strongholds were spaces of ground fenced about with a ditch, and great trees felled overthwart each other; their buildings within were thatched-houses for themselves and their cattle: In peace, the upland inhabitants, besides hunting, tended their flocks and herds, but with little skill of country affairs; the making of cheese they commonly knew not; wool or flax they spun not; gardening and planting many of them knew not; clothing they had none, but what the skins of beasts afforded them, and that not always; yet gallantry they had, painting their own skins with several portraitures of beast, bird, or flower: Towards the sea-side they tilled the ground, and lived much after the manner of the Gauls their neighbours, or first planters; their money was brazen pieces or iron rings; their best merchandize tin, the rest trifles of glass, ivory, or such like, yet gems and pearls they had in some rivers; their ships of light timber, wickered with ozier between, and covered over with leather, served not therefore to transport them far, and their commodities were fetched away by foreign merchants; their dealing, plain and simple, without fraud; their civil government under many princes and states, not confederate or consulting in common, but mistrustful, and oftimes warring one with the other: their religion was governed by a sort of priests or magicians, called Druids, from the Greek name of an oak, which tree they had in great reverence, and the misletoe especially growing thereon. Pliny writes them skilled in magic, no less than those of Persia; by their abstaining from a hen, a hare, and a goose, from fish also, saith Dion, and their opinion of the souls passing after death into other bodies, they may be thought to have studied Pythagoras; yet philosophers I cannot call them, reported men, factious and ambitious, contending sometimes about the archpriesthood, not without civil war and slaughter; nor restrained they the people under them from a lewd, adulterous, and incestuous life, ten or twelve men, absurdly against nature, possessing one woman as their common wife, though of nearest kin, mother, daughter, or sister; progenitors not to be gloried in. But the gospel, not long after preached here, abolished such impurities; and of the Romans, we have cause not to say much worse than that they beat us into some civility, likely else to have continued longer in a barbarous and savage manner of life."

Britain neglected by the Romans.—The Britons lived unmolested by the Romans for near a century after the invasion of Julius Cesar, various causes preventing the first three emperors, his successors, from carrying their arms into the island. During the greater part of this time they paid no tribute, and only on particular occasions sent gifts to the capitol. Their country, however, became pretty well known throughout the empire, from the reports of travellers and merchants, who continued to visit it. Of their internal affairs, nothing very memorable is related. Tenantius the younger son of Lud, succeeded Cassibelan, and is noted as a just and warlike prince. After him came his son Kymbeline, or Cunobeline, said to have been brought up in the court of Augustus, and to have continued on the most friendly terms with that monarch to the end. Then followed Adminius, and his brothers Togodumnus and Caractacus.

Visited by Claudius.—It was in the joint sovereignty of these two last princes, that the emperor Claudius, desirous of doing something that might merit the honours of a triumph, and signalize his reign, resolved on the complete conquest of the island, to which he was apparently farther induced by the treacherous solicitations of Bericus, a Briton, but, as is imagined, banished his country for some seditious purposes. Claudius first sent over Plautius, one of his generals, by whom the two princes were separately defeated with great loss. The emperor afterwards arriving, obtained another victory, subdued some of the states, and, contrary to Roman economy,

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which allowed the title to be taken only once in the same war, was several times saluted *Imperator*. But his moderation in a more important matter was displayed towards the Britons, by whom he was venerated, in consequence, with religious honours. Their excessive gratitude, nevertheless, was not extended to the Romans in general, with whom, on the speedy departure of Claudius, they continued to carry on a desultory and ruinous war, in which Vespasian and his son Titus, both of them afterwards made emperors, greatly signalized themselves.

Plautius, who had been left commander-in-chief of the army, in the absence of the emperor, after various successes, and subduing a great part of the island, returned to Rome, where he had the honour of an ovation decreed him. Ostorius Scapula, sent over in his place, met with many difficulties, but by prudence, spirit, and contriving to gain over some of the native princes to his cause, gradually extended his power; and at last encountering the main body of the Britons, under their noble and valiant leader Caractacus, obtained a decisive victory. That prince himself was shortly afterwards delivered up into his hands by the queen of some of the northern states, to whom he had fled for protection, but whom dread of incurring the Roman vengeance prompted to such a violation of fidelity.

Magnanimity of Caractacus.—The long and able resistance of Caractacus was matter of astonishment and indignation to the Romans. His capture afforded no less satisfaction. The Emperor, accordingly, willing to gratify the malignant passions of the people, and desirous himself of seeing a man whom bravery and skill, though not fortune, rendered so formidable an opponent, ordered him and his family, who were also taken captive, to be sent to Rome. A day was then appointed for exultation, when the people assembled, and the Emperor, with Agrippina his Queen, sat enthroned, to enjoy the triumph of his slavery.

It was on this trying occasion that the manly Briton, having, with undaunted countenance, followed the sad pageantry of his household, his brothers, his daughters, and his wife, all in chains, stood before the imperial tribunal, and made the following short but animated speech, as related by Tacitus: "If my moderation in prosperity had equalled my rank and fortune, I should have come to this city as a friend and not as a captive; nor would you have disdained to accept the offered alliance of a man, sprung from such illustrious ancestors, and acknowledged chief of so many nations. My present condition is no less dishonourable to me, than it seems gratifying to you. I once had horses, subjects, arms, riches,—what wonder is it that I should unwillingly relinquish them? Think not, because you wish for universal empire, that, therefore, all mankind will readily submit to slavery. Had I been earlier betrayed, neither my calamity nor your glory would have been so illustrious. Your ungenerous treatment of me may, indeed, be forgotten; but if you preserve me uninjured, I shall certainly become an eternal monument of your clemency." The emperor, moved at so spirited an address, immediately granted him pardon, and decreed liberty to all the prisoners.

The natives still resist.—The Britons, not yet subdued, had in the meantime taken advantage of some negligence on the part of Ostorius, who now conducted himself as if he had rather to reap the fruits of victory, than to render it availing. A bold attack on some of his troops roused him to a sense of danger, and renewed his exertions; in several skirmishes which followed, he recovered the ground which he had lost; but impatience and vexation at such continued, and, in reality, now no longer honourable warfare, at last ended his days. His immediate successors disappointed expectation. Paulinus, a prudent and experienced officer, appointed by Nero, was more successful. He effected the conquest of Mona, understood to be the island of Anglesey, and esteemed the chief seat of druidical mysteries and veneration. But, while engaged in this undertaking, a general insurrection among the Britons, thinking to profit by his absence, and stimulated by intolerable injuries, forced him to attend to the safety of the Roman colonies, now threatened with their vengeance.

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Are totally defeated.—About this period Boadicea, queen of the Iceni, (the inhabitants of Suffolk and Norfolk,) in whom the most indecent and barbarous usage had stirred up a spirit of vindictive bravery uncommon in her sex, headed her tumultuous countrymen, to the number it is said of more than 200,000. They attacked with effect several settlements of the Romans; London itself, which Paulinus, though anxious to succour, had found it requisite to abandon, fell into their hands, and was soon reduced to ashes; no less than 70,000 persons, inhabitants of it and some adjoining towns, being, at the same time, put to the sword. So signal a display of resentment seemed to imply the absence of both hope and desire of ever coming to any peaceable understanding with the Romans. It was no less signally revenged by a total defeat of the Britons, about 80,000 of them being slain on the field, and Boadicea afterwards poisoning herself from grief and shame at the loss. To add to their miseries, a famine, the natural consequence of their present unsettled habits, swept off great multitudes. Paulinus used his victory with little moderation; and being thought, by his rigorous measures, to have irritated the Britons to excess, was speedily recalled. The command was now given to Cerealis, who maintained the authority of the Roman arms. To him succeeded Frontinus, equally fortunate in preserving and extending his power.

Entire subjugation by Agricola.—The complete reduction of the country, notwithstanding the perpetual and vigorous exertions of the Romans, was not accomplished till the reign of Titus, under the government of one of their most illustrious men, Julius Agricola, whom Vespasian had sent over in the end of his life. His first campaign gave promise of his glory, both as a soldier and a promoter of the arts of peace. The victories which he gained over the Britons were made conducive to their improvement; and in a few years the whole of England, submitting to the power of his arms and his judicious policy, assumed the name and appearance of a Roman province. Nor was he inattentive to its future security. The establishment of walls, and a chain of garrisons, between the friths of Clyde and Forth, undertaken by his orders, was intended to guard against invasion from the Caledonians, who had experienced indeed something of the terror of his name, but by no means generally acknowledged his authority.

Romans defend their conquests.—Nothing very important occurred after this time till the reign of Adrian. This emperor, during a short visit to the island, built a rampart between the Solway frith and the river Tyne, to protect what was Roman from the ravages of the northern barbarians. But this wretched substitute for patriotic hardihood was only of use when defended by disciplined soldiers. It was repeatedly transgressed, and in the reign of Antoninus Pius, considerably injured, which induced that monarch to send over one of his officers for the purpose of chastising the invaders, and confining them within narrower limits. A renewal of their ravages excited the still more energetic resentment of the emperor Severus, who extended the province far into the north of Scotland; but perceiving at last the extreme insignificance of his conquests, he finished his labours by building a wall very nearly in the same situation as Adrian's rampart. This monarch died at York in the beginning of the third century after Christ.

The island improves, is again divided, &c.—The spirit of the Britons was now completely quiescent under the Roman yoke, and readily admitted the various refinements which it was the policy of the masters of the world to promote among their subjects. For some years, accordingly, the dull uniformity of events in the island was but occasionally broken by dissentions among the Romans themselves, or the paltry visitation of some northern stragglers, who contrived to evade the vigilance or elude the pursuit of the soldiery. Good historians were become scarce; those who were in any measure respectable, found objects of more consequence to engage them than the concerns of a distant and little prized province. The few events worthy of being recorded may be therefore briefly stated. The emperor Probus permitted the cultivation of the vine in Britain about A. D. 276. In the reign of Dioclesian, a persecution of the Christian religion, which had been early introduced into the island, and extended rapidly, took place. Several persons of consequence were put to death for their faith, especially at Litchfield, "for which cause," says an old writer, "that city doth bear, for their seal of arms, a field charged with many martyrs." Constantius Chlorus, who succeeded to the western empire, was more mercifully disposed, and is said, indeed, to have become a convert during his former command in the island, through the instrumentality of his wife, Helena, daughter of a British prince, and mother, as some think, of Constantine the Great. Constantius died at York in 307, immediately on commencing an expedition against the northern people, but not before he had the satisfaction of seeing his son, now named, and appointing him his successor to the throne. During Constantine's reign the Britons enjoyed profound peace, and were at liberty openly to profess Christianity. Having divided the empire into four governments, this island became subject to the præfect of Gaul, and was administered by a *vicarius* or deputy under him. Hitherto, at least for some time, it had been subdivided into two provinces, but now, by Constantine's direction, into three, denominated,—*Britannia Prima*, which comprehended all the country south of the Thames, having London for its capital, and so called from its having been first conquered; *Britannia Secunda*, containing all the country west of the Severn to the Irish sea, now called Wales, with Caerleon, or Chester, for its capital; and *Maxima Cæsariensis*, comprehending all the remainder, lying northward of the Thames and eastward of the Severn, having Eboracum or York for its capital.

Troubled by the Scots, &c.—The Britons suffered much in the reign of Constantius, one of the sons of Constantine, from the cruelties and exactions of Paulus, an officer sent over by him, and suffered, in spite of various complaints, to continue his iniquitous proceedings. Their country was invaded in the time of Julian by the Picts and Scots, now become extremely troublesome; and still more so in the reign of Valentinian I. several of whose officers were worsted in attempting to keep them in check. Theodosius the elder, at last appointed by him to this undertaking, was more fortunate in beating them back into their own territories. This general repaired London, at this period greatly declined from its former splendour. He farther extended the Roman power in the island, and built various fortresses for the defence of the inhabitants. Maximus, in the reign of the second Valentinian, was no less successful against the Scots, many of whom he forced to fly into Ireland and the adjacent isles. But they returned in a subsequent reign, and, in conjunction with the Picts, pursued their wonted ravages on the northern borders.

The Romans withdraw, A. D. 426–448.—The period was now hastening, in which the accumulated distresses of the empire precluded the possibility of affording adequate support to this remote province. Repeated solicitations, in which the Britons displayed little of their former spirit, were ultimately met with a reply which absolved them of their allegiance, and left them without hope of farther assistance. The last service which the Romans performed was the rebuilding of the wall of Severus, when they took their departure, after a residence and dominion of about four centuries duration. This took place in the reign of Honorius.

The Saxons invited over, A. D. 450.—It does not exactly appear what kind of government was left in the island; but it is certain, that, in a short time, the different and frequently-contending parties and states found it necessary to acquiesce in the ascendancy of a prince named Vortigern, or Gwrtheyrn, king of Devon and Cornwall, by whose advice, after some unsuccessful endeavours to repel their northern invaders, the Britons determined on calling in the Saxons to their aid. Some of these people had already landed in the south of England, which they were in the habit of visiting during their piratical expeditions. Their countrymen at home readily acceded to a request so flattering to their country and so promising to their expectations. Hengist and Horsa, sons of Witigisil, their general, were appointed to the command of about sixteen hundred men destined to this service. They were welcomed with extraordinary joy, and put in possession of the isle of Thanet, which, after some altercations among the states, had been selected as the fittest place for their landing, and their residence when about to return to their own country. Their first engagement with the Picts and Scots, who had by this time advanced as far south as Stamford in Lincolnshire, confirmed the opinion and hopes which were entertained of them. These confident invaders, astonished at their appearance and military skill, made but feeble resistance, and speedily fled from the field; nor was any subsequent attempt on their part more fortunate. They therefore gradually abandoned their conquests, and finally retired to their own country.

The Saxons contrive to remain.—A discovery was now made of the weakness of the Britons, and at the same time the comparative fertility and agreeableness of the island, of which their new associates were not tardy in availing themselves. Hengist, the leader of the Saxons, discerning his feeble character, contrived to engage the attention of the British prince, whilst some schemes for acquiring power were carried on. With this view he introduced his daughter to that vicious man, but, with affected modesty, declined an offer of marriage, till won by the generosity of Vortigern, who, becoming indulgent from impatience, grants a portion of Kent to the Saxons, in addition to the isle of Thanet, now represented as too small for their augmented numbers. This was followed by permission to bring over still more of his countrymen, under his son and nephew. It was suggested, that if they were allowed to settle towards the north of the island, they would operate as a continual check on their troublesome neighbours. Northumberland was accordingly assigned for their residence. But the consequences of such imprudent policy were soon manifested. Causes of quarrel arose between the Britons and their artful visitors, who fully developed their designs by actually forming alliance with the very people whom they had engaged to repel. This odious treachery excited the indignation of the Britons. A rebellion against Vortigern, whose imprudence and vices had occasioned general dislike, ended in his deposition. The people now put themselves under the command of Vortimer, his son, and fought many battles with the Saxons. In one of these Horsa was slain; so that Hengist was left sole leader of his countrymen. Reinforcements from Germany enabled him to prosecute his object with vigour. He accordingly spread the terror of his name throughout the island, sparing neither age nor sex, wherever any resistance was made to his victorious army. Thousands were butchered, and many more, dreading a similar fate, fled over to the continent, where they were humanely received, and at last settled in a province, which, from them, has ever since borne the name of Brittany.

They are ably opposed.—Hengist had now assumed the title of king of Kent, but was far from having attained the height of his ambition. New difficulties presented themselves. Ambrosius, a noble Briton, but of Roman descent, having been chosen leader of his countrymen, either on the death of Vortimer, or in preference to him, in some degree revived their courage. This enterprising man not only arrested the progress of their enemies, but also greatly allayed their mutual animosities, which were perhaps fully more injurious. It was in the army, under this chief, that Arthur, afterwards so illustrious, first appeared. The unexpected opposition which he thus encountered, obliged Hengist to call over more of the Saxons to his assistance. These, under Ella, landed at Whittering in Sussex. The war was resumed, after some respite, equally necessary for both parties. Ambrosius gained a signal victory over that general and his two sons, which necessitated the Saxons to retire to their strongholds, till supplies of troops came from Germany. Hengist himself did not live to finish the war, but died in 488, after residing in Britain thirty-nine years. His successor in the kingdom of Kent did not inherit his father's talents, and preferred the pleasures of peace to the fatigues of war. This enabled Ambrosius to improve his victory by the capture of London, Winchester, and Lincoln, which had formerly been seized by the Saxons.

Death of Arthur in 542.—A truce followed for about three years, in which time Arthur, who had greatly signalized himself, made a voyage to Jerusalem. On his return he found as much occasion as ever for his exertions. Successive reinforcements of Saxons, induced by the reported prosperity of their countrymen, had now arrived in the island, and aiding one another, gave great vexation to the Britons. In addition to the original kingdom of Kent, two separate estates were established, that of Ella in South Saxony or Sussex, comprehending Surrey, Sussex, and the New Forrest, and extending to the frontiers of Kent; and that of Cerdic in West Saxony or Wessex, including the counties of Hants, Dorset, Wilts, Berks, and the isle of Wight. It was chiefly in opposing this last named prince and his son Kenric, both of whom had landed in 495, that Arthur obtained his fame. He is reported to have vanquished the Saxons in twelve battles. But his personal valour and military talents were not alone sufficient to retrieve the declining fortunes of the Britons. His last days were imbittered by domestic trials, and he had the misfortune to be mortally wounded in a battle between him and his own nephew Modred, in the 90th year of his age, without perceiving that his heroic deeds could avail to prevent as they had retarded the subjugation of his country.

Complete establishment of the Saxons, 586.—After the death of this prince, the affairs of the Britons went speedily to ruin. No man of equal abilities arose to guide them by his counsel, or lead them to victory. A few attempts to resist their oppressors failed in their object; and more foreigners continuing to arrive at various times to share in the spoil of their country, completed their destruction. Many of those who survived such repeated defeats and the cruelty of the Saxons, took refuge in Wales, where the kindness of nature provided a defence in almost inaccessible mountains and rocks. Others, nearer the eastern side of the island, fled to that part of the continent where their countrymen were already settled. A few submitted to the power of the conquerors, accepting of life on low and unworthy conditions. Thus, after an obstinate and sanguinary contest for 130 years, the whole of England was re-

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duced under the government of the Saxons. The people so denominated were, properly speaking, of three tribes, to whom the distinct names of Saxons, Jutes, and Angles have been given. They appear to have come originally from the same region, viz. the southern part of the peninsula of Jutland, and some adjacent isles, and, from their similarity in several respects, may be considered as the offspring of one stock. The first of these names has been retained in the history of this country, as generally applicable to its conquerors, but the island itself derived its most usual title from the last of them. Accustomed, from an early period, to subsist by piracy, these people had little cultivated any of the arts which contribute so much to human happiness. They were brave and hardy, indeed, but extremely rude in manners, addicted to gross vices, and scarcely less odious superstition, and shewed an utter dislike to that system of religious and moral truth which had already made considerable progress in the land of their conquests, but which they persecuted with the bitterest and most unrelenting rage.

Summary account of the Saxon States.—The government established by the Saxons in Britain, has commonly been denominated a Heptarchy, as supposed to comprehend the seven kingdoms of Kent, Sussex, Wessex, East-Anglia, Essex, Northumberland, and Mercia. But the title of Octarchy is more appropriate, Northumberland being divided into Bernicia and Deira.

The kingdom of Kent was established by Hengist. His son and successor, Escus, but not the inheritor of his abilities, scarcely retained the dominions bequeathed to him. In the reign of Octa, who then followed, Essex and Middlesex were dismembered from Kent, by the new establishment of the East Saxons under Ella, on whom Escus had conferred the command of the Saxon army. After this prince reigned Hermenric, the father and colleague of Ethelbert, one of the most illustrious monarchs in the history of these times. His first attempt to recover the lost dignity of his family was unsuccessful. He was worsted by Ceaulin, king of Wessex, whose ambitious designs, and oppressive conduct, at last produced a league among the other states. Ethelbert, chosen their general, defeated him in turn, and speedily acquired ascendancy in the island, all the princes, with the exception of the Northumbrian, chusing to submit to his power rather than run the risk of contention. The haughtiness and arbitrary principles of this monarch were a little moderated by his apprehension of exciting such a coalition against him as had ruined Ceaulin. He prudently, therefore, relinquished some measures which he perceived to occasion dislike, and so preserved himself from the like fate. The most remarkable event in this prince's reign was the introduction of the Christian religion, originally by means of Bertha his wife, daughter of Caribert, king of Paris, whose influence over her husband so far prevailed over his prejudices, as to give encouragement to Pope Gregory the Great to send over Augustine as a missionary among the Saxons. This monk arrived in England in 597, and immediately commenced his spiritual labours. Ethelbert himself became a convert, and his example was soon followed by his subjects. This prince died in 616. None of his successors was either possessed of his talents, or enjoyed his good fortune. The kingdom of Kent soon languished, and was merged in the time of Baldred, its last prince, in the dominion of one monarch over the Saxon states.

The kingdom of Northumberland was established by Ida in 547. On the death of this prince in 559, it was divided into two parts, already mentioned, Bernicia and Deira. His successors were no way eminent till 590, when Adelfrid, prince of the former, distinguished himself by his military talents and his re-combining the two kingdoms, to the prejudice of Edwin, rightful heir of the latter, whose misfortunes, wanderings, prosperity, and death, have altogether more the interest of fiction than the evidence of truth. His reign in Northumberland was marked by the introduction of Christianity, the rigorous administration of justice, and a reputation for activity and power which secured the highest respect among the other states. Envy of his greatness prompted the Mercians and Welsh to form a league against him. This led to a battle, in which, from excessive grief or rage at the death of his son, who was slain at his feet, he plunged amongst the ranks of his enemies, and fell in the 48th year of his age. The affairs of his kingdom went immediately to ruin, the conquerors behaving with extreme cruelty, and the people themselves being divided as to the succession. After various calamities, and an interregnum, Oswald, son of Adelfrid, ascended the throne of both kingdoms. He is represented as a religious and able prince, but his short reign did little service to his country. He perished in battle with Penda, king of the Mercians, the enemy of Edwin, and was succeeded in Bernicia by his brother Oswy, and in Deira by Oswin, son of Osric, formerly king of the same country. The former having murdered Oswin, reunited the two kingdoms in his own person, but his affection induced him to divide it with his natural son Alfred, to whom he gave Deira. Egfred his son, by a daughter of Edwin, succeeded him in Bernicia, and, by a revolt of the people, acquired also that kingdom, Alfred being obliged for a time to retire into Ireland. This prince dying without issue, Alfred was recalled, and put in possession of both kingdoms, which he had extreme difficulty to preserve against the attacks of his neighbours. The subsequent history of Northumberland presents a series of discontents, anarchy, and calamities, which fitted it for complete subjection to a foreign yoke on the dissolution of the Octarchy.

The kingdom of East-Anglia, containing the counties of Norfolk, Suffolk, and Cambridge, was founded in 575. Its history is almost totally uninteresting. Earpwold, the fourth king, embraced Christianity, and afterwards abandoned it at the suggestion of his wife. Sigebert, his successor, was educated in France, where he acquired a more rooted attachment to that religion. Ethelbert, the last prince, was murdered by Offa king of Mercia.

The kingdom of Mercia, comprehending the middle counties of England, was established about 590, by Crida, to whom, after an interval filled up by the conquest of Ethelbert king of Kent, succeeded his son Wibba. Of Penda, the next but one in succession, mention has already been made in the history of Northumberland, to which he proved so vexatious an opponent. He was slain in battle in the 80th year of his age, after a restless and sanguinary reign. Wulfer his son, like himself, was a pagan at ascending the throne, but afterwards embraced Christianity, in which faith his children were educated. The greatest princes of this kingdom were Ethelbald and Offa, in the beginning and middle of the 8th century. Offa, particularly, is distinguished by military spirit, successful enterprize against the kings of Kent and Wessex, and his having acquired the friendship of Charlemagne. His merit is eclipsed by great hypocrisy, and the treacherous murder of Ethelbert king of East Anglia. Wiglaff, the last king, had, like all the other Saxon princes his contemporaries, to submit to the superior power of Egbert king of Wessex.

Kingdom of Essex.—The history of this state, founded in 527, is extremely imperfect, and void of any subject deserving much notice. Sabert, who ascended the throne in 604, embraced the Christian religion at the solicitation of his uncle Ethelbert king of Kent. His three sons, who jointly reigned after him, forsook his faith, and were all cut off in battle with the kings of Wessex. Sigebert, denominated *the good*, who succeeded his father of the same name, but styled *the little* from his smallness of stature, restored Christianity in his dominions. Swithred was the last king.

The kingdom of Sussex, founded by Ella in 477, makes as poor a figure as the preceding. Cissa, son of Ella, had a reign of seventy-six years duration, the only peculiarity for which he is remarkable. Leaving no issue, Ceaulin king of Wessex seized the kingdom. This occasioned a league against him, by which he was overcome; but he was not prevented from leaving it to his nephew and successor Ceolric. It was the misfortune of this small state to be almost constantly exposed to the dominion of some powerful neighbour, till its union with Wessex, by which all the rest were finally vanquished.

Wessex was founded by Cerdic in 519, but not without the greatest opposition on the part of the former inhabitants, a circumstance which might both have required and kept up that high degree of military spirit displayed by the Saxons of this state. Kenric, the son and successor of Cerdic, defeated the Britons in 552. After him reigned Ceaulin, who extended his territories by wars with that unfortunate people, but who, by provoking some of the Saxons of thea djoining states, and incurring the dislike of his own subjects, was expelled from his throne, and died in exile. Kyneglis, who mounted the throne in 611, embraced Christianity. His successor, Kenwalch, was victorious over the Britons. He left his crown to his widow Sexburga, a woman of great courage, by whom it was kept till her death. After some princes of no note came Ceodwalla, celebrated for his abilities, and then Ina, one of the most illustrious princes during the Saxon dominion. He was successful over the Britons, whom he afterwards treated with exemplary mildness; he compiled a body of laws, and published them throughout his territories; he built and repaired several places of worship; and, after a prosperous reign of thirty-seven years, he made a pilgrimage to Rome, and, on his return, devoted the remainder of his days to pious seclusion from the world. His cousin, Adelard, succeeded him; then, after two unimportant princes, followed Kenulph, who gained several battles against the Britons. In the reign of Brithric his son, from 784 to 799, the Danes, now formidable at sea, are said to have made their first appearance in the kingdom of Wessex. This prince was poisoned by his wife, which occasioned the West Saxons to enact a law prohibiting the wives of their future sovereigns from taking the title of queen, or sitting on the throne of their husbands. It was during this reign that Egbert, grand-nephew of Ina, and afterwards so great a personage, began to attract the regard of this people. He had too much good sense not to perceive the danger of popularity under a jealous monarch, and accordingly withdrew in time to the court of Charlemagne, where his natural talents found a suitable soil for their growth and perfection, and where, it is no less probable, his political views were pointed to the ostensible advantages of an extensive territory under the guidance of one skilful head. Opportunities were afterwards afforded him of realizing some of them in his own land.

Egbert crowned king of England, A. D. 827.—The death of Brithric occasioning a vacancy in the throne, Egbert was recalled from France in order to fill it. At this period he was the only surviving descendant of those Saxon warriors who had conquered Britain, which, together with his great reputation, may have conduced to such a preference. His first measures were moderate and conciliatory, calculated rather to heal the differences which had arisen among the various states, than to excite alarm as to his intentions of profiting by them. He was accordingly often chosen mediator among the princes, which necessarily gave him influence, and furnished information suitable to his views. A politic attack on the Britons in Cornwall seemed still more decidedly to indicate his patriotic disposition; but, while engaged in this enterprize, his own dominions were invaded by the king of Mercia, a measure which plainly justified and required the most resolute opposition on his part, and afforded a pretext for a very different line of conduct from what he had hitherto pursued. He obtained a victory over that prince at Wilton, and, during the pursuit of the enemy into their own country, dispatched some of his forces, under his son Ethelwolf, into Kent, where the people had shewn a dissatisfaction with the reigning monarch, which promised him a fair opportunity of acquiring the sovereignty of that nation. His hopes were realized in both directions. The Mercians were entirely subdued, and Kent acknowledged his power. The other states were successively obliged to fall into his hands, that of Northumberland being the last which submitted. A general council of the clergy and laity, assembled at Winchester, crowned him king of England, by which name the united kingdom was now called, nearly 400 years from the time when the Saxons first arrived in the island.

Arrival and progress of the Danes.—The ascendency of so able and enlightened a prince, by combining the energies of the separate states, doing away their dissentions, and directing their respective advantages to the improvement and happiness of the whole, promised a state of prosperous tranquillity to the island. But this was far from being enjoyed. The frequent arrival of the Danes, in great numbers, on various parts of the western coast, was a source of continual apprehension and general uneasiness. Egbert prepared to repel and chastise their temerity, but not with that promptness or efficiency which their magnitude and formidable appearance required. In his first battle with them, at Charmouth in Devonshire, in 833, accordingly, he had the misfortune to sustain great loss, though the invaders were ultimately obliged to take to their ships for safety. About two years afterwards he was more successful, obtaining a signal victory over them at Hengston-hill in Cornwall, which for a time freed his country from their assaults. Egbert did not long survive this event. He was succeeded by Ethelwolf, a prince of much less ability, and whose resistance to those invaders was far from being equally effectual. He obtained indeed one complete victory; but, as he speedily sunk into sloth and superstitious debasement, this occasioned only a temporary delay to their progress. The visits of these people became more frequent than ever, and excited universal alarm, no place being secure from their depredations, and scarcely any power able to repel them. Instead of exciting and guiding the energies of his subjects, Ethelwolf proceeded on a pilgrimage to Rome, taking with him his fourth and youngest son Alfred, on whom he had at least the merit of bestowing all commendable affection and care. On his return, about a year afterwards, he was surprised to find a conspiracy had been formed to expel him from the throne, in which his eldest legitimate son Ethelbald, on the death of Athelstan, natural son of Ethelwolf, and appointed by him king of Kent, took a principal share. In the issue, the kingdom was divided, the father accepting the eastern part, and the son being appointed to govern the western. The former survived this partition two years, and left his share of the dominion to Ethelbert, another of his sons, who, on the death of his brother, reunited the two kingdoms. This virtuous but weak prince had the folly to bribe the Danes to leave the country, which, as might have been expected, encouraged their visits. The short reign of his successor, Ethelred, the third son of Ethelwolf, was full of calamities, notwithstanding his own bravery, and the assistance he derived from his younger brother Alfred, on whom, at his death, occasioned by wounds received in battle against the Danes, he devolved a kingdom rent with civil discord by the secession of the Northumbrians, and exposed to the ravages of a fierce and overwhelming enemy.

Reign of Alfred, A.D. 871.—This heroic and magnanimous prince had scarcely ascended the throne, when the success of the Danes demanded his most strenuous exertions. In the first engagement with them he was worsted; but this did not repress his spirit, nor did he relinquish his opposition, till the defection of his soldiers, intimidated by frequent misfortune, which they thought a judgment of heaven against them, forced him at last to abandon his regal attire, assume the garb of a peasant, and for some time owe his preservation to the obscure insignificance of a herdsman's cottage. Here, it is related, he had to encounter the rebuffs of his hostess, who was ignorant of his dignity, but was nevertheless a good judge of domestic concerns. Being one day directed to attend to some cakes which were preparing at the fire, while other matters engaged her superior skill, the prince, musing on his altered state, and meditating the recovery of his country, neglected to turn them, which the old woman perceiving, smartly upbraided him, saying, "he was always very ready to eat her warm cakes, but seemed careless enough about toasting them." A ray of hope visited him in this lowly retreat. Some of his most faithful adherents gathered together under his advice, and planned the overthrow of their unsuspecting oppressors. One advantage conducted to another, till the Saxons, increasing in numbers, and resuming courage with success, found themselves able to risk a general engagement, which was decided in their favour, after immense slaughter of the Danes, the remainder of whom either submitted to his authority, or were suffered to depart from the kingdom. Alfred's subsequent reign was full of glory, and dispensed multiplied benefits on his country; so that altogether his history has exhausted the commendation of historians, and furnished a fruitful topic for poetic embellishment. He was succeeded by his son,

Edward the Elder, A.D. 901.—This was a valiant and active monarch; but the circumstances of his reign prevented the developement of some of those excellencies on which his father's reputation was founded. He had early to encounter a dispute with his cousin Ethelward, who claimed the crown, and who was for a little supported in his pretensions by the Danes, and afterwards by the Normans, with whom he had been assisted out of France; then he had a war with the Danes, especially those of Northumberland, on their own account; to which succeeded a quarrel with the Welsh. Having fortunately recovered from these and other difficulties, he began to display his qualifications as a legislator and peaceful monarch, when death interrupted the accomplishment of his designs, after a reign of twenty-four years. His natural son,

Athelstan, A. D. 925,—succeeded to the throne. In the reign of this prince, the Scots, under Constantine, assisted the Northumbrian Danes in their efforts to embroil the kingdom, and were punished by his making an inroad into their own country, which was only abandoned on their humble submission. The same northern prince, nevertheless, soon formed an alliance against him with some Danish pirates and Welsh chiefs, who were jealous of Athelstan's power. He overcame them in a great battle near Brunsbury in Northumberland, after which he possessed his crown in peace. In his time the Scriptures were translated into the Saxon tongue.

Edmund I. A. D. 940,—ascended the throne on the death of his brother. He was an able and excellent prince, but his short reign admitted not all the benefits which his subjects expected from his talents and virtue. He subdued a king of Cumberland who had sided with the Danes, and reserving merely the sovereignty, bestowed it on the king of Scotland, with a view of attaching him to his interest. This probably gave rise to the notion of the Scottish kings being vassals to the kings of England, which they were, indeed, as to Cumberland, but by no means for their own country. Edmund's reputation was not confined to his native land, but spread so much abroad that the king of Denmark, though solicited by his countrymen in England, did not think it safe to encounter his enmity by sending them reinforcements. The sons of Edmund being too young to govern, he was succeeded by his brother,

Edred, A. D. 946,—in whom devotional feelings, and complete subservience to certain ecclesiastics, especially the famous Dunstan, abbot of Glastonbury, were curiously combined with vigour of spirit and firmness of character. The former prevailed towards the close of his reign, and rendered it less enterprising than it might otherwise have been.

Edwy, A. D. 955,—who now ascended the throne, was son of Edmund, and nephew of the last monarch. Equally able with his uncle, he differed widely from him in his notions of the clergy, who had already crept into power. Dunstan, formerly entrusted with an influence and authority which appeared to admit no controul, was very unexpectedly ordered to account for some monies received during the preceding reign, and refusing compliance, was deprived of his offices, and banished the kingdom. Such a shock to popular feeling and spiritual pride, proved more injurious to Edwy himself than to the object of his dislike. Odo, archbishop of Canterbury, who espoused the cause of the monk, pronounced a divorce between Edwy and his wife Elgiva. That unfortunate beauty was destined to endure still greater proofs of the vindictive rage which animated the ecclesiastic,—being seized in the palace by a party of soldiers under Odo's directions, branded in the face with a hot iron, to designate her character as a strumpet and adultress, banished into Ireland, and, on her return, again seized and put to death in a painful and barbarous manner. In the mean time, a revolt against Edwy on the part of the people, instigated by the clergy, and latterly headed by Dunstan himself, who now found courage to visit England, became so general as to force him to accept of an associate in the government in the person of his brother, by whom he was soon afterwards succeeded in the possession of the entire kingdom.

Edgar, A. D. 959.—This prince owed his premature elevation to the influence of the ecclesiastics, whom he felt bound in gratitude, as well as by a sense of interest, to favour on all occasions. The consequence is obvious, in the reputation which he acquired with the chief historians of the period. Some portion of credit is, no doubt, due to the real excellencies of his character, which, without any monkish partiality, would have demanded commendation. Few English monarchs, in truth, have enjoyed more present satisfaction and greater posthumous fame, notwithstanding certain immoralities and a spirit of gallantry, which, in a monarch less devoutly disposed towards his advisers, would have called forth severe animadversions. He has been denominated *the Peaceable*, to denote the uniform tranquillity of his prosperous, and, on the whole, beneficial reign. The reputation of this prince attracted many foreigners to his court, by whom, it is said, the manners and simplicity of the natives were greatly corrupted. But complaints of this kind, originating generally in prejudice and mistaken views of the nature of society, must be listened to with extreme caution. England, during the time of this prince, was so much infested with wolves, that, after various measures for their extirpation proved ineffectual, Edgar commuted the tribute which had been imposed on the Welsh chiefs, into three hundred heads of these animals, to be presented annually. This excited such successful industry in hunting them, that in a little time not one of them was to be found in the country.

Edward the Martyr, A. D. 957,—ascended the throne on the death of his father; but his reign, which was of only four years duration, offers nothing remarkable to notice. His claims to the title of Martyr, generally attached to his name, are not well explained by historians, and are certainly very dubious. He died young, indeed, and by assassination, through the instigation of his step-mother Elfreda. The former circumstance may, perhaps, imply innocence, and the latter has been ascribed to his affectionate regard for Dunstan and the monks. But these together, one should think, scarcely could have procured for him a place in the Roman martyrology, merited anniversary commemoration on the day of his death, or effected any sort of miraculous power at his tomb.

Ethelred II. A. D. 978,—succeeded his brother. He was a weak, incompetent, and unfortunate prince. In the third year of his reign, the Danes landed in different parts of the island, and committed great ravages. They were little opposed by the inhabitants, whose multiplied dissensions, superstitious reliances, and distrust in the government, rendered them an easy prey. Ethelred, more than once, endeavoured to redeem his country from devastation, by the offer of a large sum of money. This was readily accepted; but had no effect in preventing a repetition of hostile visits, by which the Danes at last obtained a firm footing, and almost predominant influence in the kingdom. Their conquest would have probably been complete at this period, if they had not been called over to the continent by Richard duke of Normandy, to assist him against the king of France, by whom his dominions were threatened. A short respite from their oppressive conduct prepared the English for more poignant affliction at their return. Ethelred, unable to make head against them, yielded to pay them thirty thousand pounds, which was levied by a tax called Danegeld, that is, Danish money, or money for the Danes. This procured a temporary good understanding between the two people, which induced many of these foreigners to settle in the country and form alliances with the natives. The king himself was now at liberty, on the death of his queen, to ask a daughter of the duke of Normandy in marriage. The success of his suit seems to have inspired him with the hope of receiving assistance from that prince when necessary, and to have prompted him, accordingly, to the commission of an act, which justly excited the resentment of the Danish nation. This was a general massacre of that people resident in the island, undertaken by his orders, and executed everywhere on the same day, without respect to age, sex, or condition. Such inhuman policy was productive of still greater calamities. The king of Denmark, hearing of the fate of his countrymen, prepared a fleet for the invasion and conquest of England. He landed in Cornwall with a powerful army, and immediately marched to Exeter, which he reduced to ashes, putting all the inhabitants to the sword. This was merely a sample of his revenge. Many other towns shared the same fate, after an army sent to oppose him had been totally defeated. He passed the winter in Denmark, but returned in the following spring, to pursue a like course of sanguinary retribution. Treachery and famine completed the miseries of the English, who were glad to purchase a little relief at any price; and Ethelred himself was forced to take refuge in the court of his father-in-law.

Canute proclaimed king by the Danes.—He had not remained above six weeks in Normandy, when he heard of the death of Sweyn, king of Denmark, who thus acquired the sovereignty of England. Canute, son of that monarch, was proclaimed his successor in that kingdom by the Danes; but the English prelates and nobility, encouraging the hopes of better times under a native prince, whom misfortune might be supposed to have taught some profitable lessons, invited Ethelred to return. He eagerly embraced the opportunity; but soon manifested his incapacity to render it either honourable to himself or beneficial to his subjects. Avarice, cowardice, and indolence, prevailed over the dictates of experience. He witnessed the greatest part of his dominions in the hands, or subject to the ravages of his enemies, almost without an effort to resist them; he had the ingratitude to suspect his countrymen of an intention to deliver him up to the Danes, as the only means of obtaining peace; and the meanness to feign himself sick, in order to avoid leading his army to battle. He died at London, after an inglorious reign of thirty-seven years, leaving a divided and almost desolate kingdom to his son.

Edmund, A.D. 1016.—This prince, from the robustness of his form, the hardiness of his constitution, and his valiant opposition to the enemy, was surnamed *Ironside.* He had courage and talent proportioned to his bodily qualifications. But all of these were inadequate to recover his country from the calamities with which it was oppressed. He had to contend with a rival no less distinguished by character, though of a weakly habit of body, and possessed of greater means than himself. The struggle between him and Canute was carried on with the greatest bravery and spirit, and with various success for a short time. These princes esteemed each other, though their contrariety of interest involved them in the fiercest hostility,—no less than five pitched battles having been fought by them in one year. Through the treachery of Edric, an English nobleman, who had given repeated proofs of villainy, Edmund at last sustained a severe defeat at Ashdon in Essex, which threatened the entire ruin of his hopes. But the affection and reliance of his subjects made still another effort to retrieve them. He collected a new army, with which he offered battle at Deerhurst in Gloucestershire. Canute, equally active, prepared to meet him. The two kings, sensible of the importance, and, probably, decisive nature of the issue, stood long in sight of each other, without giving the signal for engagement, when Edmund, in order to prevent the effusion of blood, proposed a personal combat with his adversary. This was prudently declined on Canute's part, but was returned by an offer to settle the dispute by the amicable decision of their principal officers. A division of the kingdom was the consequence, much to the displeasure of Edmund, though his regard to principle, and apprehension of a dispute with his nobles, who were extremely solicitous to put an end to the miseries of war, secured his observance of its conditions. He did not survive this painful event above a month, having been murdered by his chamberlains, at the instigation of the execrable Edric, who imagined, but very erroneously, he should thereby ingratiate himself with the Danish monarch.

Canute, A. D. 1017,—now obtained entire possession of the kingdom, the two sons of Edmund, who were minors, being unable to maintain their claims to their father's dominions, and their two uncles, the brothers of that prince, at this time residing in Normandy. After firmly establishing himself on the throne, which he could not do without some severities, he began to display a moderation and humanity of disposition, much more reconcileable with his character, and which, with his prudence and good sense, have procured him an enviable distinction in history. He sent many of his followers out of the country, in order that they might not give offence to the natives; administered justice impartially to both people; and, with a view of confirming the good understanding between them, married Emma, sister of Richard duke of Normandy, and widow of Ethelred, to whom the English looked up as the guardian and protectress of their interests.

After thus settling his authority, Canute undertook a voyage to Denmark, where his presence was requisite to resist an invasion made by the king of Sweden. In this expedition he was assisted by several English noblemen, especially Godwin, whose brave and successful, but by no means warranted attack on the enemy, procured the commendation of Canute, and the title of Earl of Kent as his reward. In another expedition to the north, Canute annexed Norway to his dominions. The latter years of his reign were pacific, and proved salutary to England. His only military enterprise was against Malcolm king of Scotland, who was obliged to acknowledge vassalage for Cumberland, and his liability to the tax of Danegelt for that province. Canute became devout towards the close of his life, built churches, endowed monasteries, and made a pilgrimage to Rome, where he obtained several privileges for his English subjects. He left three sons, Sweyn and Harold, by his first wife, Alfwen, daughter of the Earl of Hampshire; and Hardicanute by Emma.

Harold, surnamed Harefoot, A. D. 1035,—succeeded to the crown of England, by the will of Canute, though in violation of the marriage treaty with his second wife, by which that kingdom was settled on her eventual offspring. Hardicanute, already in possession of Denmark, conceived himself wronged by this appointment, and being favoured by the English, slowly prepared to assert his pretensions. Harold, on the other hand, had the suffrages of the Danes, and was, besides, on the spot to secure the vacant throne. A compromise between them left London and the provinces north of the Thames in the possession of Harold, while the southern part of the island was ceded to Hardicanute. This agreement proved of short duration, Harold having contrived, by acts of the most barbarous and deceitful nature, to get the whole kingdom into his own hands. But he enjoyed the fruit of his crimes only four years, when he was succeeded, with the joint consent of Danes and English, by

Hardicanute, A. D. 1039,—whose reign of two years was marked by violence, injustice, and want of feeling, which rendered his sudden death, in a fit of debauch, a cause of congratulation to his subjects. In him terminated the Danish dynasty. The Saxon blood was restored to its regal honours in the person of

Edward the Confessor, A. D. 1041.—This prince had no just title to the throne, there being a nearer descendant of the last Saxon monarch, viz. Edward, son of Edmund Ironside, at that time an exile in Hungary. But the people were so delighted with the idea of a deliverance from a Danish yoke, as to call to the throne any member of their native stock whom they could first find possessing a pretension to sovereignty. This step gave umbrage to the Danes, who contended for the title of Sweyn, the remaining son of Canute. Had this prince consequently been in the island at the time, it is probable that the kingdom would again have been plunged into the miseries of civil war. Edward was enabled to maintain himself in the throne, notwithstanding the murmurs of the Danes, and the intrigues and opposition of his mother Emma, whose unkind behaviour he visited with very unbecoming severity.

His reign was for some time troubled by Earl Godwin, whose daughter he had married, but whose power, deceitfulness, and ambition, were too great to admit of much tranquillity in the critical conjuncture of affairs. On being at last freed from this dangerous man, and from a threatened invasion by Sweyn, Edward employed himself in collecting, arranging, and improving the laws of his country. This was a beneficial task; but the weakness of his mind inclining him to superstition, prevented the attainment of great excellence as a prince. To some constitutional defect rather than to self-denial, ought to be ascribed that chastity for which he was so noted, and which, in place of deserving commendation as a virtue, was rather to be deplored as a misfortune, inasmuch as it precluded the possibility of obtaining an heir to his throne, and consequently might have exposed his country to the hazard of rival claims. Edward is the first English monarch that is said to have cured the disease called king's evil, by touching the patient.

Harold, A. D. 1066,—son of Earl Godwin, ascended the throne without opposition, though Edgar Etheling, grandson of Ironside, was the rightful heir. The people in general, whose affections he had gained, readily favoured his cause, as well from expectation of future benefits as gratitude for past services. Nor were the clergy or nobility backward in sanctioning his elevation. He took effectual means to confirm them all in their good opinions and hopes, so that his reign promised universal satisfaction. But his plans and enjoyment of majesty were speedily interrupted by a message from William, duke of Normandy, demanding the crown of England, in virtue of an agreement formerly made between them, by which Harold had promised to assist that ambitious prince in his designs on the kingdom. Harold was not in a humour to regard any engagement so prejudicial to his own interest, and which, at all events, appears to have been imposed on him when absolutely in the power of his rival. William, again, who asserted that he had been appointed heir by Edward the Confessor, followed up Harold's refusal and defiance by vigorous preparations for invasion. He landed with an immense army at Pevensey, on the coast of Sussex, where he abode for about a fortnight, to refresh his troops, ascertain the state of the public mind, and arrange the plan of his future operations. Harold, in the meantime, conducted his forces from the north, where he had been eminently successful against his brother Tosti, by whom his dominions were attacked. The two armies met at last near Hastings, in Sussex, destined to be the spot on which was fought one of the greatest battles hitherto known in Europe. It terminated the reign and the life of Harold, whose valour repeatedly promised to secure the victory, but whose death, which took place by an arrow, was the signal for the defeat and rout of his countrymen. Nearly fifteen thousand Normans, and a greater number of English, fell in this decisive engagement. Thus ended the Anglo-Saxon dynasty, after a duration of about six centuries. A new order of things commenced with the reign of

William the Conqueror, A. D. 1066.—After returning thanks to heaven on the field of battle, the victorious Norman marched towards London, where the consternation of the people, which at first displayed itself in a vain and dangerous purpose of resistance, at last sought refuge in an offer of the crown. The Duke, with apparent reluctance, but real joy, accepted the boon, and promised protection to the church, deference to the laws, and the impartial administration of justice. His power as a conqueror, therefore, was rendered somewhat less grating to popular feeling, by the semblance of a conditional election. The rest of the kingdom, either from dread of his vengeance, or inability to find a proper opponent to his ambition, acquiesced in this decision; and thus by one adventurous, and undoubtedly rash enterprise, a foreigner, without right or title, found himself firmly placed on the throne of England.

The first measures of William were by no means agreeable to his new subjects. He divided the lands of those who had opposed him among his Norman barons, quartered others of his followers on the religious foundations of the country; disarmed the city of London, and any of the other towns which gave the least shadow of offence to his suspicious mind;

devolved all power into the hands of his own countrymen; and took effectual measures to introduce his native customs, laws, and language, in place of those which were established in the island. Such policy, though severe and ungenerous, was successful. A few commotions, of short continuance, and easily overcome, were the only disquieting events to which his reign was exposed, so far as the people were concerned. But he was less fortunate in his own family, and in his continental dominions. He ended his days abroad, when on a visit to resent a personal insult from the king of France.

William II. A. D. 1087,—was the second surviving son of his father, and succeeded to the throne of England by a will made on the death-bed of that prince. Robert, the elder brother, who had Normandy assigned to him, was the favourite of his countrymen, by whom he was prompted to lay claim to the kingdom, on the ground of primogeniture. Had the activity of his mind borne proportion to the extravagance of his habits, or to the zeal of his friends, he might have proved a very dangerous rival to William. But his indolence ruined his cause.

William, freed from any apprehensions on his brother's account, which had constrained him for a time to court the affections of the English, began to manifest a tyrannical and covetous disposition. His exactions pervaded alike private right and the sacredness of religion. A dangerous illness gave his subjects some prospect of being freed from oppression; but his recovery frustrated their hopes, and shewed the fallacy of those resolutions of repentance with which he had amused the pious credulity of his ecclesiastical attendants. He resumed his former course with additional ardour, as if in revenge for those peevish promises which sickness extorted. A war with Malcolm, king of Scotland, in which he now engaged, was fatal to that prince. This was followed up by an attack on the Welsh, who were equally unfortunate in losing their sovereign. Then occurred a fresh dispute with the duke of Normandy, in which the French first took part against Henry, but were afterwards bribed to relinquish hostilities. He was therefore enabled to prosecute his contest with Robert more advantageously, and, in all probability, would have made himself master of all the dominions belonging to that unfortunate prince, if an incursion from the Welsh had not obliged him, very reluctantly, to return home. These were driven back to their mountains; and the king prepared for another continental expedition. But this was prevented by a conspiracy to dethrone the king, in which Robert de Mowbray, earl of Northumberland, was the chief agent. It bore an alarming aspect, but was speedily dissipated by the vigilance and decision of Henry, who generally contrived to render any disturbance or disaffection a source of additional power and revenue.

A single incident, on a small scale, illustrates part of this prince's character. Anselm, archbishop of Canterbury, rather haughtily maintained the immunities of the church, and, being otherwise offensive, incurred the king's displeasure. Thinking himself roughly treated, he applied for leave to go to Rome. William first refused, but afterwards being well enough pleased to get rid of the prelate, granted him permission. With the intention, however, of passing another indignity on him, as well as profiting by the opportunity, he directed an officer to follow Anselm on his journey, who, overtaking him as he was about to sail, ransacked his luggage, and took away all the money he could find, assigning for a reason, that it was contrary to law to carry the royal coin out of the country.

A zeal for the recovery of the Holy Land from the possession of the infidels, which at this time began to prevail so extensively over Europe, occasioned a circumstance still more gratifying to the temper of William. This was an offer on the part of his brother Robert, who eagerly engaged in an enterprise promising such supereminent reward, to mortgage Normandy for a sum of money which was requisite for his due equipment. The king, relying on his talents as a financier, especially with the wealth of the clergy as materials to work on, instantly promised the stipulated sum of 10,000 marks, which he proceeded to levy with all imaginable dispatch, silencing any murmur or complaint by the hypocritical assertion of the pious motives for such a sacrifice. Thus, Normandy was again united to England,—a connection which entailed a series of wars with France, without ultimate advantage to either country. William himself, though abundantly proud of his bargain, found little or no benefit to accrue from it. The people were fond of independence, and not very well disposed to submit implicitly to his commands. Frequent insurrections among them required his personal exertions; and no sooner was one trouble got over than another arose to disquiet him. These annoyances were far from diminishing his ambition. The earl of Poictiers, intent also on the crusade, but lacking money for the necessary preparations, had recourse to him, with a similar offer to mortgage his dominions, which was accepted with no less eagerness than he had formerly shewn. He was actually engaged in arranging measures for taking possession of the territory thus consigned to him, when he accidentally received a mortal wound from an arrow shot at a stag by Sir Walter Tyrrel, a French knight, who used to accompany him in his hunting excursions. Thus fell William II. denominated Rufus, from the colour of his hair, in the 40th year of his age, unlamented by his subjects, whom he had oppressed, and without legitimate issue to inherit the crown, which he had so unworthily worn for about 13 years. In the 11th year of the reign of this prince was made the last attempt at the invasion of England by any of the northern nations. It was conducted by Magnus, king of Norway, but was successfully opposed by Hugh, earl of Shrewsbury. The practice of agriculture which now began to occupy these people, obviated the necessity, or broke in upon the desire of making hostile visits to foreign countries.

According to a stipulation between them, Robert ought to have succeeded to the sovereignty of England on the demise of William. But that luckless prince, whose courage and generosity contributed to blazon the capture of Jerusalem, had lingered a year in Italy, where his affections were engaged by the accomplished and beautiful daughter of Count Conversana. By this delay he lost the opportunity of establishing his title, and afforded time for his younger brother, then in the island, to secure the royal treasure, the liberal use of which, and an excellent address, supplied the defect of right, and filled the vacant throne in the person of

Henry I. surnamed Beauclerk, A. D. 1100.—Much prudence was needed to maintain the impression by which this usurper, for so he must plainly be considered, acquired his present exaltation. Some temporary concessions, besides their political expediency for the common weal, might, he thought, so rivet the affections of the people, as to make any efforts on his brother's part very inefficient. He soon perceived the advantage of this judicious conduct, when Robert, indignant at such unbrotherly and perfidious behaviour, made a descent from Normandy, with an army to enforce his claims. Several of the nobility, it is true, on hearing of the resolution which brought that prince to England, were disposed to retract their allegiance to Henry, either from a consciousness of the defect of his title, or an apprehension that his present complacency was merely assumed, and would be followed by far less agreeable manifestations. But the influence of Anselm, whom he had recalled, greatly to the satisfaction of the people at large, effectually prevented a general defection, and induced the soldiery to promise fidelity to the king. When the two armies came in sight, accordingly, their respective leaders, foreseeing that more would be lost than gained by a conflict, proposed an accommodation, which was ultimately settled. By this treaty, Robert, in consideration of a certain sum of money, resigned his pretensions to England. He resided for two months with his brother in apparent harmony, and then returned to his own dominions. New animosities afterwards arose between them, but, being adjusted, Robert paid another visit to Henry, and interceded in behalf of some of his adherents, whom the vindictive king had begun to chastise for their indiscreet attachment. The reconciliation was of no long continuance. A more embittered contest than ever took place, the issue of which was destruction to the unfortunate and imprudent, but not unamiable Robert, who, in one battle, lost all his dominions, and, with nearly 10,000 of his men, was made captive. The treatment which he afterwards experienced from Henry forms an indelible stain on the memory of that monarch. He was detained in prison for the remainder of his life, which was of twenty-eight years duration, and, by some historians, is said to have had his eyes put out by order of his resentful brother.

Henry returned in triumph from his Norman expedition, and soon gave evidence, by the haughtiness of his manners and his arbitrary proceedings, that success had made no improvement on his character. The rest of his reign was comparatively quiet, notwithstanding a behaviour on his part which was well calculated to excite the envy of foreigners, and generate dissention among his subjects. His nephew William, son of Robert, supported for a time by the king of France, carried on a very unequal struggle, which had for its object the recovery of his father's dominions. The fortune of Henry prevailed in a decisive battle, in which, though severely wounded, his personal courage obtained the victory. This brought on an accommodation with the French king, who was glad to abandon William's interests for the sake of maintaining his own. The subsequent efforts of the young prince were still more unpromising; and his death, in about eight years afterwards, completely freed his uncle from trouble on his account. The king's disputes with Anselm, about ecclesiastical matters, were neither carried on nor terminated so much to his satisfaction. He incurred popular odium, the prelate being universally considered as the chief bulwark of the Christian faith; he was menaced with a sentence of excommunication by the pope, a judgment which, in those days, entailed very serious evils on the unhappy delinquent; and he was at length under the necessity of resigning the right of granting investitures, by which he had the power of appointing prelates, and which, in fact, was one of the chief articles in the contest.

A domestic calamity, which also affected his political projects, gave a more serious and permanent shock to the prosperity of Henry. This was the loss of his son William, whom he had got recognised as his successor by the states of England, and had just carried over to Normandy to receive homage from the barons of that duchy. In returning from this visit, the prince and many of his companions, belonging to the best families of both countries, were wrecked, through the disorderly conduct and inebriety of the seamen. His own life would have been spared, had not a generous affection for his sister, whose cries he heard aboard the vessel, induced him to attempt her rescue; when too many having rushed into the long-boat, in which he hoped to accomplish his object, occasioned its sinking. Only one person, a butcher of Roüen, is said to have escaped from this catastrophe, by clinging to the mast of the ship. This afflictive event so distressed the king that he was never afterwards observed to smile.

Henry having now no other legitimate son, was anxious to secure the succession to his daughter Matilda, whom he had first married to the emperor Henry V. of Germany, and afterwards, on the death of that monarch, to Geoffrey Plantagenet, so called from a sprig of broom which he wore in his bonnet, eldest son of the count of Anjou. This was among the last objects of his ambition; and he so far at least succeeded in it, as to obtain recognisance and oaths of allegiance from his barons both in England and Normandy. In preparing to return home from this last country, in order to arrest an incursion of the Welsh, he was seized with a violent disorder, said to have been occasioned by eating too freely of lampreys, which put a period to his life in the 67th year of his age. Few princes have displayed such a combination of useful talents and elegant qualities. To a noble and commanding appearance, he joined a courtesy of address, which was requisite to engage the confidence of those whom his dignity, and high reputation in the art of governing, would have awed into timidity and self-distrust. The readiness and force of his eloquence gave full effect to his authority, by impressing a conviction of the superior wis-

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dom which actuated his counsels, and a good acquaintance with the literature of his time, which could not have been realised without studious application, indicated the possession of faculties, and a power of will, which in themselves, independent of their consequences and results, are worthy of admiration. In military skill, and personal prowess, he does not seem to have been surpassed, at a time when mankind in general had frequent opportunities of cultivating the art of killing one another. His chief defect, as a monarch, was a resoluteness of temper which endured no obstacle, and often led him to disregard both the opinions and the feelings of his subjects;—his vices, as a man, were inordinate ambition, an unforgiving disposition, and the excessive love of women.

No greater proof of the instability and precariousness of human hopes and designs need be given than the complete failure of Henry's project in favour of his daughter. This originated in a quarter from which, considering his liberality and indulgence, he had anticipated the firmest support. But his own precautions, in reality, defeated his purpose. Thinking to secure their affection, and bind them to maintain his will, by which Matilda was appointed to succeed him in the throne, he heaped favours on Stephen and Henry, the two youngest sons of his sister Adela, who had been married to the count of Blois; and still farther, in the prosecution of his plan, had invited them over to England some years before his death, and, by various grants and honours, raised them to the highest rank among his subjects. Such conduct fostered the ambition of the former of these, and gave him the means of accomplishing a higher destiny. His behaviour and munificence readily procured him favour with the people, nor did he want those qualities which were effectual to obtain esteem from the nobility. There seemed, then, to be required only desire and ingratitude enough on his part to violate, with success, the most sacred, and, certainly, very reasonable injunction of his uncle. These were not long to be looked for in his character. Immediately on hearing of the king's death he quitted Normandy, where he had been on a visit, hastened over to England, and, passing by Dover and Canterbury the citizens of which, aware of his intentions, shut their gates against him, arrived at London, in which he had good reason to believe he should experience a much more gracious reception. Nor was he disappointed. Through the intrigues of his brother, the bishop of Winchester, the vacillation of Corbel, archbishop of Canterbury, the dishonesty of Bigod, steward of the household, who averred that the late king, his master, had on his death-bed disinherited Matilda, and nominated his nephew as heir to the crown, together with the total disregard of the nobles to oaths which they had repeatedly taken, but thought of no moment when policy or interest contended with religion, and the general good will which the populace bore towards him, did this rash and unprincipled adventurer gain access to a throne to which he had no right, and the possession of which he had solemnly sworn it was his duty, and would be his effort, to preserve for the nearest relation of his confiding benefactor.

Stephen, A. D. 1135.—Thus, then, triumphed the lust of power and earthly glory, over some of the strongest obligations by which the feelings, the honour, and the conscience of mankind are imagined to be secured. A victory achieved by such sacrifices demanded no ordinary solicitude and circumspection. The first measures of the new king were of a nature to confirm the only tenure by which he held his sceptre. But the motives and reasons for his granting charters and indulgences, were too conspicuous, and too energetic, to be neglected by those who found either profit or a gratification of vanity in his concessions. Wishes naturally prompted requests, and these gave way to demands, which again multiplied, by a kind of self-production, much beyond the necessities of the case, or the conveniences and just prerogative of the sovereign. Stephen was now involved in a dilemma, in which, perhaps, no wisdom could ensure his safety, but by enforcing an act of justice and retribution by no means agreeable to human nature. It was equally fatal for him, in all likelihood, to attempt to recover his dwindling authority, or to acquiesce in the reiterated devices by which it was fast sinking into insignificance. His temper inclined him to the former expedient; and he therefore began on a suitable occasion, and with the appearance of propriety, by obliging some of his bishops to deliver up their castles, which, in unseemly imitation of the nobility, they had recently erected. This was immediately resented as an insult and breach of charter, by the whole ecclesiastical body, not excepting even his own brother, whose zeal for the church seemed in this instance to exceed regard for so near a relative. Indeed a disgust which had for some time occupied the breast of that prelate, because he had not been admitted into the administration of affairs, as he had expected from his former services, rather induced him to rejoice in an event so opportune to resentment. The dispute was ardent and pertinacious; but in the end Stephen had cause to repent of a step which, however right in itself, and even expedient as a measure of state, was almost certain to give mortal offence to one of the strongest parties in the country, and through their influence to excite a revolt among the people.

In this perilous crisis of Stephen's affairs did Matilda arrive in the kingdom, full of indignation at his conduct, and resolute in her purpose to dethrone him, which the consciousness of a just title, and the promises of some friends in the country, headed by the earl of Gloucester, one of the natural sons of her father, warranted her to entertain. The whole of her retinue at first was only a hundred and forty knights, but this was speedily augmented, so that she thought herself strong enough to contend with the usurper. A civil war now followed, in which the miseries of the country, and the rage of the combatants, were rarely relieved, even in point of effect and appearance, by some of those traits of heroic enterprise and chivalrous generosity, which occasionally radiate the gloomy and terrific conflicts of our species.

After various indecisive engagements, the arms of Matilda were victorious over her rival, in a dreadful battle, fought within sight of Lincoln. The King, who had signalized himself by a valour and intrepidity which would have done honour to any cause, fell into her hands. He was at first treated with respect, but afterwards, on some suspicions, was closely confined to prison, and put in irons. His cause now appeared utterly desperate, since, besides his being entirely in the power of his opponent, his followers were but few and scattered, and disheartened beyond the effort to rally. Every thing, on the contrary, promised gratifications and security to Matilda. Her title was just, which alone, in other times, would have proved a host of strength; her success confirmed her first adherents, and daily attracted more; the clergy in a conference admitted her claims; and the highest dignitary of the church conferred the sanctities of religion on her coronation. Yet were all her fair prospects deceitful, and doomed to be speedily obscured, greatly, if not entirely, by her own imprudence and utter inability to manage those persons and parties by whose influence she had thus far prevailed. A revulsion of public feeling was the consequence, and the bishop of Winchester, who again undertook the cause of his brother, notwithstanding his recent services and oaths to Matilda, contrived to instigate measures which at last drove her from the throne to make way for the captive and humbled, but now restored Stephen. Another civil war ensued, with a similar tissue of disorder, devastation and barbarity. The decision was protracted for some time; but the death of the earl of Gloucester, who had been her chief support, gave a shock to the cause of Matilda from which it never recovered. Still the affairs of the unhappy Stephen were far from being composed. He had incurred the displeasure of the church; his party lay under an interdict from the pope; Matilda still possessed many friends; and though last, not least in the catalogue of evils which threatened his enjoyment, the son of that lady, now approaching to manhood, had exhibited an assemblage of excellencies which could not fail to procure very general esteem and admiration.

This prince, by marriage with Eleanor, heiress of Guienne and Poitou, was enabled to give considerable effect to his hereditary claims, and present a formidable augmentation to the opponents of the English monarch. He landed in the country, where he was immediately joined by most of the barons, took several fortresses, and having rapidly collected a respectable force, advanced to give battle to Stephen. The two armies met near Wallingford, and were about to engage, when the earl of Arundel, one of the king's party, strongly urged the preference of an amicable adjustment, which was agreed to on both sides. Eustace, the eldest son of Stephen, at that time about eighteen years of age, reluctantly beheld the preparations for a treaty, in which he imagined his interests would be materially committed; but his death, which took place during its advancement, removed one of the chief difficulties in the way of its completion. This event, so painful to the king, rendered his accession to the terms more facile and expeditious than might otherwise have been expected. He still demurred, but perceiving the falling away of some of his adherents, and other symptoms of a more disagreeable catastrophe, he consented to settle the succession on his antagonist, while he himself was suffered to retain the crown during his life. Prince Henry now evacuated the kingdom; and Stephen, at last freed from the difficulties which had so long overwhelmed him, began to taste some of the fruits of peace, and to manifest qualities and behaviour which promised the recovery and welfare of his long distracted country, when the arm of death arrested his course in the 50th year of his age. This prince had several virtues. He was brave, generous, merciful; a foe to oppression, a lover of equitable laws; and, possessed of competent abilities for the due government of a nation, he might have stood high in the rank of kings, if an error in the outset of his career, and the temper of the times, had not presented insuperable barriers to the attainment of excellence.

Henry II. A.D. 1154. So decided and universally acknowledged was the title of this prince, that during a period of six weeks which he continued in Normandy after hearing of Stephen's death, not a shadow of opposition, or the least appearance of difficulty, arose to obstruct his accession to the throne. The community, wearied with past dissentions, seemed, with one consent, rather to wait peaceably for the arrival of a master whose authority and power they had neither inclination nor ability to dispute, than to take advantage of a delay so suitable for new commotions. His first measures were perfectly congenial to the reputation he had already acquired for firmness and political sagacity, and appeared calculated to extend the duration of the quiet which now prevailed. He demolished several castles, which had become the repositories of pillage rather than contributed to the welfare of the subject, and fortified or repaired others, as the security of the kingdom might be supposed to require. He dismissed all the foreign soldiery, from whom the people had suffered a good deal of oppression and injury during the preceding reign. He called in the old and adulterate coin, and substituted a new currency, of a proper standard. He granted charters to several towns, by which means the citizens became independent of any superior but himself, and their political liberties were consequently much enhanced. Thus the exorbitant influence of the barons, according to the influence of the feudal government, was impaired, and a vigorous party brought into the state, on which the monarch might rely in some of the most arduous duties of his administration. A more doubtful step was the revocation of some grants made by his predecessors, and the resumption of lands formerly alienated from the crown. The possessors were not a little irritated at their deprivations, and in a few cases absolutely refused submission to his decrees. But resistance was vain, where so great a strength as the king's was always ready to support authority. He even carried his reforming practices so far as actually to reduce certain individuals to the condition of commoners, on whom the late king had bestowed the honour of the peerage, alleging as a reason for such degradation, that these titles were rewards for favouring the cause of an usurper. Nothing but the consciousness of irresistible power could have prompted so prudent a man to adopt such modes of rectifying abuses. He now called a council of state, consisting of the most eminent persons from the nobility and clergy, in which, among several measures for the general security of his government, he consented that the laws of Edward the Confessor, to which the people had been wont to look as the perfection of legislative wisdom, should be in force throughout the kingdom. By this single enactment a sense of safety was diffused over all classes of the community, excepting those whose crimes and evil inclinations awakened in them an alarm of speedy and efficient retribution.

Having accomplished so much for the peace and prosperity of England, Henry was called abroad to oppose the injurious attempts on the provinces of Anjou and Maine, made by his brother Geoffrey. These were frustrated on his appearance, and the people, somewhat shaken by the pretensions of that prince, returned to their allegiance as subjects of the king. An incursion of the Welsh next demanded his care, which was successful in procuring their submission. Then the death of Geoffrey gave him a claim to the territory of Nantz, in which he prevailed over the rival interest of the Duke of Britanny, whose death some years afterwards opened up his title also to that principality. He was not equally fortunate in an attempt to attach the principality of Toulouse to his continental dominions, in right of his wife's mother, only issue of Count William IV. This engaged him in a contest with the king of France, which little benefited either party, and which was at last terminated by the mediation of Pope Alexander III. at that time resident in France, whither he had been driven by the anti-pope Victor IV.

Henry might now have expected that his reign should present little opposition for the future. But it is with princes as with most men. Their difficulties and trials generally arise from unsuspected quarters, and at times when they promise themselves more than usual enjoyment. On his return to England commenced an arduous and protracted collision with the clerical power, in which one of his own subjects, raised to hostile distinction by his liberality, acted a part most injurious to royal feelings. This was the famous Becket, a man of humble origin and insignificant connections, possessed of moderate talents, and rather dubious morality, but insinuating, circumspect, artful, of the most aspiring ambition and ungovernable pride, and a resoluteness of spirit, which, if not engaged merely in the promotion of his own interests, would have merited a very enviable encomium. An account of Henry's curious and eventful dispute with this singular personage has been already given under the word Becket, and need not be repeated. The murder of the prelate, by no means imputable to the king, unless in so far as the expression of dislike on his part excited the barbarous and unprincipled zeal of the assassins, was in reality one of the circumstances in the case most unfortunate to Henry, and which he had the greatest difficulty to surmount with a becoming regard to his own dignity. At this distance of time, and in a very different state of things, a superficial observer could scarcely help reflecting on the abjectness, and seemingly heartfelt nature of his subsequent penance at the shrine of the newly elected saint, as a disparagement both of his innocence and his judgment. But to one who should carefully contemplate the prejudices of the period, and the necessity which Henry experienced of being reconciled to the church, in order to recover the affections of his subjects, his conduct in this trying particular will seem a venial expression of human infirmity, if not a justifiable sacrifice of personal consequence to political expediency. Considered in the latter point of view, it had the merit of success, which, with most men, is an argument of a very satisfactory kind. His effectual opposition to his continental enemies, aided as they were by his own undutiful sons, and his victories over the Scots, with whom he was also at war, were imputed to his renewed favour with the departed martyr,—the general persuasion of which entirely broke up a conspiracy against his government, and enabled him with some comfort to renew his labours for the glory and welfare of his country. By very little effort, a short time before this reconciliation, he had made the conquest of Ireland, which has ever since remained an invaluable appendage to the English crown.

The last years of this great and sagacious monarch were embittered, almost beyond example, by the perverse and unnatural behaviour of his four legitimate sons, who sometimes conspired together, and at other times endeavoured singly, to weaken his authority, dismember his dominions, and, in reality, terminate his reign. The dying, and probably sincere repentance of the eldest of these, whom he had crowned as partner and successor in the kingdom, and the sudden death of another, perhaps the most vicious of the whole, did not produce any effect either in reclaiming or appalling the remaining two. One of these, Richard, now heir to the crown, most perfidiously formed alliance with the king of France, Henry's inveterate enemy, by whose means he was enabled to obtain advantages over his father, which forced him at last to make compliances equally unusual and disagreeable. It was not the least mortifying of these, that the king should grant indemnity to such of his vassals as had entered into the ungenerous confederacy against him. But what was his vexation and grief, when, at the head of the list of those who were thus to be protected from well deserved resentment, he discovered the name of his favourite son John! The sight was too much for parental feeling, already so cruelly disappointed, and now without a shadow of hope that its tenderness could be returned. He expressed himself in the language of despair, regretted the birth of so unhappy a being, and, in an agony of soul, pronounced a curse on his children, which no solicitation afterwards induced him to retract. A lingering fever succeeded to this paroxysm, and ended the miseries of Henry in the 58th year of his age. All the historians relate an occurrence consequent on his death, of a most impressive nature, and which, in days when superstition had so much sway, was interpreted as a divine rebuke. When Richard, already experiencing the pangs of remorse, approached the corpse, blood was seen to gush from its mouth and nostrils. The spectacle struck him with horror; he burst into tears, exclaimed he was the murderer of his father, and acknowledged, in the most pathetic manner, the undutifulness and cruelty of his behaviour.

Thus died Henry II. one of the ablest and best of princes, considered in the various characters of warrior, politician, and legislator. In the less ostentatious, but nevertheless important, and perhaps more trying relations of domestic and private life, it is almost impossible to discover more than one very serious failing; and for this, some allowance, though by no means a justification, will assuredly be made by those who are best acquainted with the manners and licentiousness of his time. The romantic story of the fair Rosamond has its foundation in an illicit indulgence, justly chargeable on this magnanimous and amiable monarch.

Richard I. A. D. 1189.—The conduct of this prince immediately after his accession to the throne, blasted the hopes of his former advisers, and all his companions in rebellion. He dismissed them from his service, and in their place employed those who had loyally adhered to his father, observing, with justice, that those who were faithful to one master would probably be so to another. After he had established himself in the government, he prepared, in the enthusiasm of the times, and according to a vow which he had formerly made, to undertake a military enterprise in the Holy Land. For this purpose, as his love of glory projected the most brilliant schemes, he was obliged to adopt several projects for raising money in addition to what he found in his father's coffers, amounting, as is said, to more than L.900,000, besides jewels. The clergy, who at this time were abundantly wealthy, took advantage of his wants to make purchases very much to their own profit, or the gratification of their worldly vanity, but by no means to the increase of their favour with the people. The sale of lands, jewels, honours, and privileges, not answering his demands, Richard proceeded to other expedients still more impolitic and disgraceful, by which, though he at last succeeded in obtaining his wish, he alienated much of the affection and esteem of his subjects. Nothing but a high opinion of his romantic zeal and ambition of fame, sanctioned by the delusions of the prevalent religion, could have prevented a formidable, if not a fatal convulsion in the kingdom, as the result of his exactions. It is unnecessary to follow him in his wild expedition, fruitful to himself of reputation as an accomplished and fortunate warrior, but utterly unprofitable to his country, or rather indeed decidedly injurious, by its immediate consumpt of blood and treasure, and ultimately by subjecting it in a large sum to redeem him from ignominious imprisonment, inflicted on him when returning home, in defiance of every honourable and generous principle, first by Leopold duke of Austria, and afterwards by Henry VI. emperor of Germany. The whole affair of Richard's detention by this last prince, on groundless charges, and merely in order to gratify his avarice, is perhaps the most flagitious piece of villany which this period, fertile in crimes, holds up to the detestation of mankind. Next to the emperor, the persons most implicated in its baseness, were the king of France, who offered him a large sum to perpetuate the imprisonment of his captive, and the Pope, who, for fear of giving offence to that monarch, refused the most pressing and affecting solicitations to intercede for a man whose life had been so repeatedly and so long exposed in the cause of the church, and whose only crime was the possession of talents, and a display of magnanimity, even in his misfortunes, which excited the hatred of envious and malignant minds.

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During Richard's absence, the affairs of his kingdom were in a very perilous condition, through the vices and incapacity of the two prelates to whom the government had been committed, and the traitorous machinations of the worthless John, who was infamous and selfish enough, in opposition to sound policy, to enter into terms with the French monarch, by which the prolongation of his brother's captivity was to be secured, and himself put in possession of the throne. But the reception which proposals to this last effect experienced from the English barons, vindicates them from participation in his iniquitous designs. On arriving in London, after a conference with Philip for the purpose now mentioned, John, giving out that he had received certain intelligence of his brother's death, claimed the crown as nearest heir. They unanimously rejected him, and took effectual measures to oppose his premature pretensions, so that he was obliged to return to France, and at last openly acknowledge his alliance with its sovereign.

The excessive joy of the English at the re-appearance of their monarch in his own dominions, must have greatly delighted a man who, though far from being a faultless character, was not defective in sensibility. Had his prudence kept pace with his feelings, he might have proved as useful as he was acceptable. But a desire to be revenged on his enemy, the king of France, exceeded the regard he ought to have shewn to the welfare of his subjects, who had already suffered more in the way of exactions and contributions than a wise or a merciful sovereign would choose to inflict. Money was requisite to carry his intentions into effect, and money must be had, whatever violations of honour and good faith might be the result. The particulars of the war which he now waged bore no proportion to the enmity that excited it, and are passed over in a cursory manner by the generality of modern historians,—a sufficient evidence of their insignificance and want of interest. One anecdote respecting an interview with his penitent brother, deserves mention. That prince, on being introduced by the queen mother Eleanor, threw himself at the feet of Richard, and begged pardon for his behaviour. "I forgive you, said the king, and wish I could as easily forget your offences, as you will my pardon." The king of France, on the whole, was most injured, for neither party was profited, by the present hostilities. Among the misfortunes he suffered was the loss of all the ancient crown records, which were taken, together with his baggage, in a battle near Blois. Mutual inability to prosecute war, occasioned a truce; and mutual antipathy as readily renewed their aggressions. After some alternations of this kind, in which the folly and vindictive feelings of both were manifested, the Pope's interference promised a more lasting tranquillity between the two combatants.

The death of Richard occurred soon after. He

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was shot by a cross-bow from the walls of the castle of Chalus in France, which he was besieging, in consequence of one of his subjects having taken refuge in it with some treasure claimed by the king as superior lord of the land where it had been found. The few excellences remarkable in this prince were fitter to attract admiration in his own age, than to command the good opinion of posterity. He was a brave and high spirited man, full of the enthusiasm of his time, and well skilled in the scanty rules, but arduous practices, of the military art which then prevailed. He had a frank and open temper, and was sincere and ardent in his attachments. But he was proud, revengeful, cruel, greedy of money, indiscriminate and excessive in sensual indulgences. A smart reply of his to a clergyman, who took the liberty of advising him to abandon his vices, especially pride, avarice, and licentiousness, which he denominated the king's three favourite daughters, was at once an avowal of their notoriety, and a display of good-humoured pleasantry: "You counsel well, and I therefore resolve to give the first to the templars, the second to the monks, and the third to the bishops.' Richard had some learning, and is understood to have possessed a genius for poetry, as is indicated by certain productions assigned to him, which are still extant. He was, on the whole, a favourite with the English, though his reign proved highly detrimental to their country, by the very oppressive and arbitrary taxes which he imposed, and his ruinous military contests, which, together with his imprisonment, kept him so much abroad that he spent only a few months at home out of the ten years during which he held the sceptre.

John, A. D. 1199.—Appointed heir to the crown by his brother, John's title was by no means incontestible. He had a rival in his nephew Arthur, son of Geoffrey, whose claims were favoured by the king of France, no longer a friend to John than he conceived likely to advance his purpose of disquieting England. War with that monarch was the consequence. It terminated, after several petty and indecisive engagements, in a treaty, which seemed intended to prevent all future occasions of discord between them. Arthur perceiving that his interests were overlooked, and having reason to distrust the attachment of the French monarch, was at last induced to throw himself on the mercy of his uncle. A little prudence and humanity would now have secured to John at least a comfortable reign, But in the composition of his character there appeared no foundation for either happiness or glory. He soon disgusted his subjects by an unprincipled and totally illegal marriage with Isabella, daughter of count Angouleme, already betrothed, and, in fact, consigned to the count de la Marche, and that, too, during the life of his queen, whom, by some means or other, he contrived to divorce, in order to accomplish his licentious purpose. But, odious as this step might appear, it was exceeded by the removal of Arthur, whom he had made prisoner in the course of a new prosecution of his claims. How this ill-fated prince was put to death, has never been satisfactorily explained. The most probable opinion is, that, after several fruitless endeavours to find a subsidiary ruffian who would undertake his murder, he performed it himself, by stabbing the youth in the very act and posture of supplicating mercy. This is said to have taken place at the castle of Roüen, on the river Seine, into which he cast the body, with a stone fastened to it, so that the horrid deed might not be discovered. All things now went wrong with this barbarous and profligate tyrant. Besides the loss of his continental dominions, he was threatened with a revolt at home, where he was as universally detested as he had formerly been feared. To the difficulties every where thickening around him, he mightily contributed by exciting the indignation of the elergy. The pope, who at one time befriended him, took part in the general opposition, at first by alarming threatenings, and successively by an interdict against the kingdom, which was calculated to excite universal horror and uneasiness, by putting a stop to all religious ordinances; a sentence of excommunication as to the king himself, by which his subjects were absolved from their allegiance; and, at last, by a decree of deposition, which made over the kingdom to his rival, Philip, the French monarch, and called for a general crusade against the object of his spiritual resentment. These measures, extravagant and futile as they would now be reckoned, brought John to a state of total ruin and wretchedness. He submitted himself, with all humility, to the pontiff, acknowledged his vassalage and dependence, consented to accept and to hold his dominions as a fief of the Roman see, and actually prostrated the regalia at the feet of the legate, who made him wait three days for their restoration. Such abject meanness, expedient or politic as it might seem to a man whom every one deserted and despised, and who had, consequently, neither affection nor character to consult, augmented, beyond all bounds, the contempt of the people. The barons, as became them, led the way in expressing the public opinion, and this they did in a manner which, whatever were their motives or their hopes, entitles them to the gratitude of posterity. They assembled, and bound themselves by oaths to united measures for the renewal and observance of a charter of privileges, formerly granted by Henry I. but of which there existed only a single copy, almost totally unknown and neglected in the kingdom. John spurned their presumption, but, perceiving their resoluteness and power, craved time to consider the demands made on him. This was a mere pretence to evade them, but failed in its object. The king appealed to the pope, who espoused the cause of his vassal. But the barons were far less scrupulous than he had been in listening to his remonstrances, at least where politics only were concerned, and, confiding in their strength, proceeded to employ the last measure for obtaining a redress of grievances. After sundry events, calculated, on the one side, to effect, and, on the other, to avoid concessions, it was agreed that the king and barons should meet, on a particular day, at Runnamede, a place between Staines and Windsor, ever since held memorable as the spot on which the *Magna Charta*, or great charter of English liberties, was procured from the sovereign. John rather rapidly yielded the points in debate, and, with great facility, signed and sealed the important documents which were presented by the nobility. This

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excited some suspicion of his sincerity, which his subsequent behaviour tended forcibly to confirm. An equitable and really expedient dispensation of political freedom, and salutary privileges to his subjects, appears to have produced in him a feeling of mortification, which neither the contumelious conduct of the pope, nor the insulting treatment he had experienced from the king of France, had been able to excite. In a temporary seclusion from company, which he now affected, he devised means for shaking off the shackles imposed on him. A bull from the former annulled the charter which he had been constrained to sanction, and the arrival of a body of mercenary soldiers, gave him the hope of retrieving the ground he had lost. The barons, grown somewhat careless and inattentive after their former success, were taken by surprise, and suffered various important advantages to be obtained, without any adequate struggle. They were at last so much reduced as to be under the necessity of seeking aid from the king of France, whose son Lewis they offered to acknowledge as sovereign, on condition of receiving immediate protection. This was too tempting a proposal to be resisted. A French army was landed in the country under prince Lewis himself, and was speedily augmented by those who had resisted the king. Affairs now wore the most calamitous appearance for the country, which could not be expected to profit by the success of either party. But a series of events, fortunately for it, disappointed the hopes, and frustrated the plans of both; and the death of John, which took place at Newark, apparently from fever occasioned by grief and anxiety, put an end to the misery and degradation of his subjects. The revolted barons readily swore allegiance to his son Henry, then only nine years of age; the people as readily recognised his hereditary right; and Lewis, after making some ineffectual struggles for the maintenance of the ground he had already gained, was obliged to make peace with the earl of Pembroke, uncle to the young prince, and now appointed protector of the realm, and, with the whole of his troops, to evacuate the kingdom. It is scarcely possible, in the annals of royalty, to find a more worthless character than that of John. Almost every action of his life indicated a base and vicious disposition. It is unnecessary, as it would be disagreeable, therefore, to specify the peculiar failings to which he was subject, and, unhappily for his fame, the assiduity of the historian would be lamentably employed in seeking for any virtue to which they might serve as foils or contrasts.

Henry III. A. D. 1216.—The death of Pembroke, which happened soon after this settlement of the kingdom, was a national loss. He was succeeded by Peter des Roches, bishop of Winchester, and Hubert de Burgh, high justiciary, men of talents and spirit, but rather disposed to arbitrary measures, which suited not the temper of the times, nor the wishes of those whom it was of most consequence to manage well. The king himself, as he reached manhood, indicated rather a feeble understanding, though he was far from being destitute of some excellencies. But even these were occasionally productive of evil, and his whole reign, which was of fifty-six years continuance, proved that a weak prince is nearly as injurious to a nation as a vicious one. A preference for foreigners, the want of economy in his government, and the consequent adoption of oppressive modes of acquiring money, gave general discontent, and excited a factious spirit, which frequently endangered his throne. The most formidable assailant whom his imprudence, general want of success, and disregard to the rights and welfare of the people, raised up against him, was his brother-in-law, Monfort, the earl of Leicester.

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By this nobleman's machinations a plan was at last formed for bringing the king to a necessity of meliorating his government, if not of entirely depriving him of it. Henry was compelled, in the critical conjuncture of his affairs, to promise the redress demanded, and actually to consent to the nomination of twenty-four barons, empowered to manage and model the regal power for the good of the community. It was to this body, over which Leicester himself presided, that England was indebted for the first rude draught of a House of Commons, one of their earliest proposals being an order for four knights to be chosen from each county, with power to examine into the grievances and wants of their constituents, and to lodge information of the same at their personal attendance on parliament. It is quite obvious, that in this measure, as in the whole of their proceedings, the barons were much more intent on aggrandising themselves, than on giving consequence and political agency to the people, for they pursued a system which promised eventually to sink all power in their own hands. Thus it is certain that an aristocracy, or oligarchy, must have speedily been established, had not opposition sprung up in the very body which they thus called into existence. The representatives of the people, now in the habit of assembling in a separate house, where they could deliberate on their own concerns and interests, both perceived and remonstrated against the impropriety of some of their measures, and did not fail to represent, in an unfavourable point of view, the contrast between the king's celerity in performing the conditions required of him; and their dilatoriness in accomplishing any thing for the public good. Not content with this spirited conduct, those patriotic men ventured even to claim the assistance of prince Edward, the king's eldest son, at that time upwards of twenty years of age, and whose talents pointed him out as likely to be of the greatest service, in settling the affairs of the nation.

The barons, seeing the urgency for some appearances calculated to appease the rising dissatisfaction, published a new code of laws, of little utility, but which they thought would, at least, have the effect of amusing the people, while they should more effectually secure their power. When the farce could be no longer continued, a parliament was called at the instance of Edward, in which the king resumed his power, after some fruitless efforts on the part of the barons to get possession of his person. Leicester, so far disappointed in his views of attaining and preserving the supreme authority, at length raised a formidable force, with which he defeated the royal army, commanded by the king and the prince, both of whom had the misfortune to be taken prisoners. The former he carried about with him from place to place, and obliged to give orders for the delivery of several fortresses into his hands, and to ratify the measures which he judged necessary for his own successful usurpation; and Edward he confined, at least for a time, in the castle of Dover. Leicester, however, was not so powerful as to be set above fear. He found it expedient to summon a parliament, in which, besides two knights from every shire, deputies from the boroughs were ordered to be returned,—a still more decided approach than had ever hitherto been made towards the constitution of an English House of Commons.

This assembly, far from answering his expectations, decided on the re-establishment of the ancient national government, and so conducted their deliberations as to induce Leicester to acquiesce in the wishes of the people. He therefore set Edward at liberty, though he still continued to watch over his motions in the most jealous manner, as if he had foreseen or dreaded the termination of all his earthly prospects in the enterprising and ardent spirit of that prince. But all his stratagems proved abortive. An opportunity presented which Edward longed for. He effected his escape, collected some forces together, and very unexpectedly for Leicester advanced to engage him at Evesham. This terminated fatally to that ambitious nobleman, who soon perceived the extreme danger of his situation, but whose intrepid valour for a time suspended the decision of victory. The aged and helpless Henry, whom he had barbarously constrained to take his station in the front of the battle, was wounded in the shoulder, and, not being recognized by his friends, would have certainly been killed, had he not cried out, "I am Henry of Winchester, your king," which immediately brought the conquering Edward to his rescue.

The royal cause, so brilliantly sustained, now flourished everywhere; and it is to the credit of the victor that he did not follow up his success by any undue severities on the vanquished and those who had favoured them, or any attempt to stretch the prerogatives of the crown beyond their former and ascertained limits. Edward, after establishing the tranquillity of the nation under the mild government of his father, embarked in the last crusade with Lewis XI. which he greatly distinguished by his valour and zeal. Having concluded an honourable treaty with the sultan of Babylon for ten years, he was on his return home when he received tidings of the event which immediately devolved the cares and the glory of the crown on his own head. It was a memorable reply which he made to the king of Sicily, who observed how much less affected he appeared on hearing at the same time of the death of his infant son, "The loss of a son is light, because I may have another, but that of a parent is great, because it cannot be repaired." Though in reality, during the Saxon period, there had been no less than three monarchs of the same name, this prince was crowned, and has always been designated, by the title of

Edward I. A. D. 1272.—The affairs of the kingdom were wisely managed during his absence, which lasted near a year after Henry's death, by a regency chosen by the barons, all of whom were ready to swear fealty to one whose right was incontestible, and whose character and talents seemed so eminently to qualify him for the throne. On his arrival, therefore, he found a state of universal tranquillity, which enabled him at once to set about rectifying some of the disorders that had arisen in the preceding reign, and to establish a rigid administration of justice throughout the country. This was highly commendable, and produced the most beneficial effects; but it was not sufficient to occupy his active mind, or to gratify all the desires of his heart. He was naturally ambitious, and possessed a haughtiness of spirit which, besides that it could brook no real offence aimed at his dignity or his interest, was apt to take alarm even at the creatures of his own imagination. And, to all this, he added a severity of judgment and feeling, which both prescribed the full amount of recompense and exacted its accomplishment. A dislike, founded on prejudice and perhaps religious opinion, drew forth a cruel and impolitic persecution of the numerous Jews who now resided in England, which is certainly a stain on his government. This was followed by a powerful enterprise against the Welsh, who had incurred his resentment, which effected the complete conquest of their country, but was not finished without a display of remorseless vengeance quite inconsistent with the character of a truly great man. It was on the traditionary, but, it is believed, authentic circumstance of his having put to death all the bards of that romantic province, whom he imagined, not without truth, to preserve the flame of heroic valour by their poetry, that Gray has founded his soul-appalling ode:

> "Ruin seize thee, ruthless king!
> Confusion on thy banners wait," &c.

The annexation of Wales to his other dominions, however brought about, was a political measure from which the greatest benefits have ever since been derived. Edward, soon after this event, had a still more splendid opportunity afforded him for the display of his military talents, and the gratification of his ambitious desires. Alexander III. king of Scotland, having died without male issue, two competitors for the crown arose in the persons of Bruce and Baliol, both descended from David I. by the female line, and whose rival claims were supported by the respective friends and adherents of the parties. The parliament of Scotland, perceiving the critical situation of affairs, and dreading the occurrence of a civil war, which must devastate the country, came to the resolution of applying to Edward to undertake the office of umpire between the opponents. Nothing could be more agreeable to this monarch than a proposal which not only promised to require his interference in a manner that might conduce to the extension of his power, but also furnished a pretext for reviving his own pretensions to a feudal superiority over that country,—a claim, indeed, hitherto so little known, or so extremely remote and trivial, as not once to have proved an argument or a reason for the Scottish barons avoiding such an occasion of bringing it again into notice. The proofs which he now adduced in behalf of his assertions were no less contemptible than his design was iniquitous. He seems to have been aware of their incompetency, and therefore took good care to furnish himself with a more convincing logic, by marching to the frontiers of the kingdom with a large army, ready to silence every objection, and take possession of the reverted estate. The parliament, and the whole people of Scotland, thunderstruck at a pretension of which no one had ever so much as dreamed, perceived, when it was too late, the blunder which had been committed, but knew of no mode of avoiding the dreadful consequences of resistance. Edward interpreted their silence as a consent to his claims,—and after requiring the competitors, who were now no less than nine more than the original pair, to acknowledge his superiority, proceeded to give sentence on the subject referred to his arbitration.

The crown was adjudged, perhaps on the best grounds, to Baliol, who immediately did homage to the English monarch as his lord paramount. Nor ought this acquiescence to be so severely censured in that individual, as has often been done, with the view of exalting the spirit of the unsuccessful Bruce, who in reality had been the first to acknowledge the king's superiority,—all the rest of the claimants, and, in fact, the barons at large, being abundantly ready to imitate his example, when they saw the power by which they were menaced, or had any hopes of advantage from their obsequiousness. Baliol soon after renounced his allegiance, which so provoked Edward that he invaded Scotland with a large army, and compelled him to resign the kingdom into his own hands. At this period appeared the renowned Sir William Wallace, to restore, in some degree, the drooping and degraded honour of his native land. With a few patriotic souls he ventured to attack some of the English garrisons, with such success as speedily augmented his numbers, and gave hopes of rescuing Scotland from the gripe of a foreign usurper. The earl of Warenne, appointed governor of the country by Edward, having retired to the north of England for reinforcements, now advanced with an army of 40,000 men to oppose him. A battle, fought at Stirling, in which the Scots were completely victorious, forced that general once more to retreat, and at last evacuate the kingdom. Wallace now assumed the title of governor of Scotland, under Baliol, then a captive with Edward. This, together with his supereminent merits, produced rather envy among the nobles, than any adequate co-operation. He resigned his authority, and contented himself with the command of those who would have no other leader. Edward hastened to retrieve his losses. He came up with the Scots at Falkirk, and defeated them with great slaughter. Still were that people far from being subdued. Various engagements afterwards took place, in which the English were by no means successful. The vexatious resistance at last instigated Edward to the greatest activity, and to the adoption of measures which have entailed just odium on his name. Wallace, betrayed into his hands, was ignominiously put to death. This more than ever exasperated his countrymen, who wanted only a leader of spirit to conduct them to revenge. Such a character was presented in Robert Bruce, the grandson of the unsuccessful competitor for the crown. This heroic man, disdaining the trammels which his immediate ancestors had meanly borne, raised the standard of rebellion in his native land, and waged defiance against the English monarch, as its enemy and oppressor. The English were again driven out of Scotland, but returned with additional forces, which, falling unexpectedly on Bruce, put his army to rout, but in no degree subdued his resolution. Edward himself, vowing a signal chastisement on a nation which, though twice conquered by himself, maintained its independence, and thwarted his ambition, hastened to the frontiers, when he sickened and died, near Carlisle, but not without enjoining his son to prosecute, without delay, his vindictive designs on that kingdom.

The reign of Edward, which lasted thirty-five years, was singularly advantageous to England. He enhanced its character, vastly improved and strengthened its laws, and by ratifying the *Magna Charta*, not willingly indeed, for he was in heart a despot, gave a security to the subject, which had never before been enjoyed. In ability, military talent, and valour, activity, and vigour of mind, this monarch was never surpassed by any prince that inherited the crown of England.

Edward II. A. D. 1307.—A contrast to his father, by his weakness, indolent habits, and unworthy attachments, this prince soon disappointed the hopes which had been entertained from his apparently amiable disposition, and freedom from any remarkable vices. His reign was inglorious, and terminated unhappily. Piers Gaveston, an accomplished, but debauched youth, whom he had made his confidant, disgusted the nobles by his vanity and haughtiness, and was at last, with considerable difficulty, abandoned to their vengeance. Edward slowly proceeded to follow up his father's advice as to Scotland, but seemed to think the expedition rather a source of amusement and pageantry, than accompanied with hazard, and requiring some personal sacrifices. His army, which amounted to about 100,000 men, having entered the country, was met at Bannockburn, within two miles of Stirling, by Bruce, whose troops were not so much as a third part of that number, but were animated by a leader and a determination which made them greatly superior to their opponents. So signal a defeat as the English here experienced, has rarely occurred. Their loss has been rated at half their amount, but this seems an exaggeration. The King himself narrowly escaped; and such was the impression which this calamity produced, that no advantage in number or circumstances could induce the invaders to face the Scots for some years afterwards.

Edward endeavoured to console himself with a new favourite, who became as odious to the nation as the former. Disaffection among the nobles, the intrigues of his profligate queen, and a series of imprudent and pusillanimous proceedings on his own part, brought on his deposition by parliament, as incompetent and unworthy to fill the throne. He was afterwards confined to prison, where the malice of some of his enemies still pursuing him, put a period to his days in a manner most shocking to humanity.

Edward III. A. D. 1327,—was only 14 years of

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age when he received the crown. He avenged the death of his father, by the perpetual imprisonment of his own mother, and the execution of Mortimer, her worthless paramour, who had brought it about. Then resolving on the recovery of national honour and his hereditary claims, he marched into Scotland, where, after some successes, he placed his tributary Edward Baliol on the throne, though he could not reconcile the people to his authority. To this enterprise succeeded his vigorous and well supported pretensions to the crown of France, which he claimed in right of his mother, on the death of Charles IV. without male issue. In prosecution of this splendid object, he carried an army to the continent, where he obtained a signal victory over Philip of Valois, who now supplied the vacancy. This was on the field of Cressy, where 100,000 French under that prince were completely routed by the English, amounting only to 30,000, commanded by Edward himself, and his illustrious son, generally called the Black Prince. In the mean time, the Scots, who had invaded England, were defeated by his queen Philippa, and their monarch David II. taken prisoner. A peace concluded between Edward and Philip, through the mediation of the pope, was broken on the death of Philip, who was succeeded in the throne of France by his son John. This monarch assembling an army, so hemmed in the English under their valiant hero the Black Prince, near Poictiers, that it seemed impracticable for them to escape destruction. He proposed, therefore, their absolute surrender, which was indignantly refused. Yet, even here, the fortune of England prevailed. The French were beaten, and John himself was numbered among the captives, and carried to London, now gratified by the spectacle of two royal prisoners. But these and other advantages little aided Edward in his ambition. He obtained, indeed, much glory, and several provinces were ceded to him; but he found it necessary to renounce the claim which had prompted him to such an expensive enterprise. The death of his magnanimous son was an affliction which so distressed him, that he became unwilling and unable to attend to public concerns. This was equally injurious to his government, his reputation, and his comfort. Those whom he trusted were unworthy of confidence which they abused, and those from whom he had a right to expect gratitude and affection, first plundered, and then deserted him,—a sad example of the instability of worldly greatness. He died about a year after his son. This reign was peculiarly oppressive to England, by the amount of taxes which were required to support the military expeditions. It was Edward III. who instituted the order of the garter. In his time the French language was abolished from law pleadings, which were formerly carried on in it.

Richard II. A. D. 1377,—succeeding to his grandfather in the eleventh year of his age, the government was vested in his three uncles, the dukes of Lancaster, York, and Gloucester, whose differences of temper, and contests for power, in addition to the feebleness and imprudence of the prince, involved the nation in great disorder and perplexity. It had suffered much from the extravagance of the preceding reign, but was threatened with still greater hardships by the mismanagement and misfortunes of the present. Among other modes of replenishing the exhausted treasury, a tax of three groats on every person above fifteen, excited peculiar indignation among the lower orders, who were thus made liable in the same amount as the rich, and who, besides this just objection, had reason to complain of the manner in which it was exacted. An insurrection, under the noted Wat Tyler, was the consequence, which had a most alarming aspect, and was with difficulty allayed. The king's liberal promises, made in a spirited manner, at a critical time, won favour with the populace, which his subsequent behaviour altogether belied. The nobles, who afterwards instituted an opposition to the administration and prerogatives of the sovereign, were more pertinacious and more effectual in their designs. Richard occasionally exhibited a firmness and resolution which augured their complete subjection; but he wanted judgment to guide him in such trying emergencies, and usually destroyed by violence, or suffered to escape by indolence and love of pleasure, the opportunities for establishing a vigorous and salutary government. A conspiracy against him, detected in time, gave the commons occasion to shew their loyalty, which a wise prince would have turned to good account. But his evil fortune prevailed. The duke of Hereford, son of the duke of Lancaster, whom he had offended and banished, taking advantage of the king's absence in Ireland, collected his followers and the disaffected, with whom he rose in open rebellion against his sovereign. The unfortunate Richard fell into his hands almost immediately on arriving in the country, and was committed a prisoner to the tower, where, after being compelled to resign the crown in favour of that nobleman, a measure which the parliament basely confirmed by a special deposition, on very inadequate, though by no means altogether unfounded charges, he was either privately assassinated, or, as is more probable, was starved to death, in the 34th year of his age. He died without issue; and now, therefore, was laid the foundation of those contentions between the houses of York and Lancaster, which so long afterwards involved the country in blood and desolation.

Henry IV. A. D. 1399.—A crown unjustly acquired is rarely enjoyed. It was impossible for men not to recollect and to blame the means by which Henry had risen to his present elevation. Nor was secret dislike, or even open censure, the only source of disquietude which he had to apprehend. The superior pretensions of Mortimer, heir of the house of York, stood ever in the way of his own hereditary claims; and, on the other hand, he had neither inclination, nor saw it expedient, to rest his title solely on the consent of the people. His right, accordingly, seemed at last reducible to possession merely; and how precarious this was might be readily understood from his own success, and a single glance at the characters and tempers of the nobility who had either favoured or opposed his cause. One benefit accruing from his uneasy convictions and his fears was an activity of mind, which rapidly perceived the approach of danger, and no less rapidly provided against it. His numerous assailants, on the contrary, were unhappy in the want of concert and combination; and though formidable enough, in all probability, to effect his ruin, rather waited their turn to be destroyed, than hastened to do justice to the motives which actuated their rebellion. The earls of Kent, Salisbury, and Huntingdon, lords Spencer and Lumley, who were among the first to conspire against him, paid the forfeit of their ineffectual resistance by their lives; a more spirited, but not more skilfully managed insurrection, under the earl of Northumberland, was defeated in a dreadful battle at Shrewsbury, where that nobleman's son, Henry Percy, surnamed Hotspur, who commanded, lost his life; then followed a confederacy between the archbishop of York, the earls of Nottingham and Northumberland, which last the king had pardoned only a short time before, and other leaders, to place young Mortimer on the throne, but which was speedily broken by the artful negociations of the earl of Shrewsbury, when the prelate and Nottingham were beheaded, Northumberland escaping the like fate by flying into Scotland.

To these difficulties, and a long continued, though not highly important state of hostilities with Owen Glendour, a descendant of the royal family of Wales, all so happily overcome, succeeded a very different sort of uneasiness, in which Henry's conduct, politically judicious as it might seem, was far less to his honour. This was a contest between the *orthodox* clergy and the disciples of the illustrious Wickliffe, in which the former so far prevailed over the scruples, or it may be called conscience of the king, and the reluctance of the House of Commons, as to obtain an act for the preservation of the faith and purity of the church, by the burning of those who were ignorant or stupid enough, or had the misfortune to think differently from the established creed! William Sawtre, rector of St Osithe's, London, was the first person burned alive in England for his religious opinions; an example of absurd and detestable severity, which the madness of ecclesiastical zeal was for long afterwards busied in imitating with awful success.

The tranquillity which his triumph over all his enemies, and a tolerable good understanding with Parliament, now promised, was disturbed by the excesses and profligacy of his eldest son, and still more, there is reason to believe, by the tumults of an agonizing conscience, which no worldly prosperity can assuage. His health declined apace; he became subject to fits, which at times bereft him of his senses; he shewed a perpetual apprehension of his losing the crown, which he had always placed on his pillow when he went to bed, lest it should be seized before his death; he vowed taking the cross, and fighting the cause of the pilgrims in the Holy land, in the event of his recovering; he counselled the prince of Wales as to the conduct he ought to adopt, not concealing from him his own doubts as to the validity of the title by which he had ascended the throne, and recommending that generous and now repentant youth to the protection of heaven, breathed his last in the 46th year of his age.

Henry V. A. D. 1413.—A solitary ray in the beclouded character of this prince, on which men had been accustomed to gaze with mingled emotions of hope and apprehension, broke into meridian splendour, when he found himself arrayed in royalty at the head of a great and expectant nation. His youthful companions in scenes of riot and debauchery were dismissed, but not without the most cordial exhortations to reform, and, at the same time, some more substantial evidences of his generous attachment; the faithful servants of his father, again, some of whom had given cause, though no reason for offence, were honoured with his confidence and employment; and, on all hands, it appeared to be his strenuous determination to cancel the recollection of his former misbehaviour, as well as the disorders of the state, by virtuous conduct and a wise administration. One error, of no trivial nature, indeed, he did not escape, though even in it he displayed a good sense and humanity of disposition, which, in an age of less bigotry, would have secured his reputation from censure. This was the giving up of Lord Cobham, accused of heresy, to the zeal of Arundel, archbishop of Canterbury. The conduct of that nobleman, it must be confessed, was not blameless; but then the crime, for which he ultimately suffered, was in a great degree the product of that religious persecution to which the king was induced to lend his sanction.

But it was the military talent of Henry, and more especially its splendid exercise against France, which procured the chief admiration of his subjects. Taking advantage of the distractions of that kingdom as favourable for the demand and recovery of some provinces formerly ceded, Henry, on refusal, prepared for invasion. A large army, which he landed at Harfleur for this purpose, became so enfeebled by disease, as apparently to present an easy prey to the enemy, who began to calculate on the amount of ransom which they should receive for their intended captives. The battle of Agincourt, therefore, was the most fortunate event which a mind ambitious of glory could desire. In several respects it resembled the battles of Cressy and Poictiers, the fame of which, indeed, seems to have mightily conduced to the astonishing valour, as well as the very improbable success of the English; but it was more fatal to France than either of them in the number of eminent persons who were taken and slain, and no less remarkable in the extreme disproportion of the loss on the part of the victors. It did not, however, obviate the necessity which Henry experienced, of retiring to England, in order to raise more men for the prosecution of his enterprise. With these he returned in the following year, and after inconsiderable opposition, and various negociations, marched to the very gates of Paris, the citizens of which, by timely agreement, obtained a truce. A treaty was now entered into between Henry and the Queen-mother, in which the duke of Burgundy, keeper of the insane or imbecile Charles VI. concurred, to the prejudice of the Dauphin. By this treaty, Henry was to espouse the princess Catherine, daughter of that monarch, and to receive the kingdom of France as her dowry, the crown of which, with all its rights and dominions, was to remain, after the death of her father, with him and his heirs, and the government of which he was now to undertake, in consideration of the king of France's frequent infirmities. The marriage was soon afterwards consummated, and Henry took formal possession of Paris, where he obtained a ratification of the preceding compact, and the oaths of allegiance from the French nobility.

There still remained an antagonist in the person of the Dauphin, against whom, therefore, he turned his victorious arms. But the contest necessarily exhausting his troops, the king had to return to England in order to provide himself with additional force. This conquest flattered the pride of his subjects, but promised them little benefit; nor could they contemplate the union of France and England under one monarch, without a well-grounded conviction that the latter would dwindle into a mere province. The parliament, therefore, shewed an unwillingness to grant him the full amount of supplies which he needed; but in this exigency he had, besides their aid, the contributions which he had levied on the conquered provinces, and accordingly soon assembled a new army of nearly 30,000 men, with which he landed at Calais. The Dauphin had not been idle during his absence, but, with great exertions, having raised a respectable force, consisting partly of a body of men sent to his assistance by the regent of Scotland, was enabled to attack the duke of Clarence, commander of the English troops, and obtain a complete victory. This advantage was soon checked by the arrival of Henry; and the Dauphin, now obliged to retire beyond the Loire, seemed driven to the very brink of destruction, when the fatal illness of his too powerful rival turned the tide of fortune in his favour. Though at the very summit of his glory, and only thirty-four years of age, Henry observed the increase of his disorder, and the approach of death, with apparent composure. He called for some of his principal nobles, and, among the rest, his brother the duke of Bedford, to whom he consigned his will regarding the government and his family, and recommended the protection and care of his son, then an infant, not quite a year old. The short remainder of his time was passed in devotion, when he expired in great tranquillity. The English historians fail to notice a single defect in the character of this prince; from the French, again, to whom it is certain he proved a most grievous foe, his reputation has received several not unimportant drawbacks. They charge him with cruelty, haughtiness, avarice, and ambition. Assuredly, some of his actions might appear to bear out each of these imputations. But the criticism which has so rigorously traced out the connection, is more to be wondered at for its industry than praised for its candour.

Henry VI. A. D. 1422.—During the minority of this prince, his uncles, the dukes of Bedford and Gloucester, were appointed protectors or guardians of the kingdom, the latter officiating in England during the absence of the former in France, where he had to conduct the war against the Dauphin. For some time the English army, accustomed to victory, and still commanded by an able and experienced officer, scarcely perceived the loss of their heroic monarch. But the face of affairs was entirely altered when, on the death of Charles VI. which soon afterwards took place, the Dauphin assumed the title of king of France, and in that capacity had the satisfaction of witnessing the gradual return of his countrymen to their natural allegiance. The success which now attended this long unfortunate prince was accelerated in a surprising degree by means which, in our day, would be considered most absurd and insignificant, but which the superstition of the times rendered abundantly efficacious. A country girl, called Joan of Arc, prompted by religious and patriotic enthusiasm, gave herself out as directed and commissioned from heaven to undertake the deliverance of France from the power of its invaders. Her pretensions, for some time ridiculed, were at last sanctioned by the courtiers of the new king, and employed to revive the courage of his desponding adherents. Under her apparent guidance, several advantages were gained over the English, who now became no less convinced of the authenticity of her mission than they were sensible of its overwhelming effects. Their ardour was proportionally damped, and for some time their losses threatened their entire ruin. Nor was their cause bettered on the breaking up of the delusion, by the capture of the marvellous object of their dread, whom they afterwards most unjustly and cruelly put to death on a charge of witchcraft. The duke of Burgundy, whose alliance had so materially aided their enterprise against his country, now perceiving the error and impolicy of his conduct, concluded a treaty with Charles, which left the English in the most hopeless condition. Their utmost exertions availed them not, and they were at last obliged to abandon the whole of their conquests, with the exception of Calais,—a miserable compensation for the blood and treasure which had for ages been squandered in the foolish attempt to annex a foreign kingdom to their native dominions. The death of the duke of Bedford, one of the greatest men whom the history of England presents to admiration, occurred a few days after the treaty which decided the continental interests of his country.

The remainder of Henry's minority was distracted by the violent factions between the duke of Gloucester and the cardinal of Winchester, to whom his education had been committed. His own imbecility, which soon became apparent, and rather increased as he advanced to manhood, prolonged the influence of the latter, by whom he was at last induced to marry Margaret of Anjou, a woman of extraordinary talents and spirit. This princess co-operated with the cardinal in opposing Gloucester, whose death, not without universal suspicion to their disadvantage, was followed almost immediately by that of his rival. But the tranquillity of England was now to be assailed in a much more deplorable manner, by the appearance and pretensions of a claimant of the crown in the person of Richard duke of York, a descendant, by his mother's side, of Lionel, the second son of Edward III. and elder brother of John of Gaunt, the forefather of the present sovereign, whose incapacity offered a fair opportunity for reviving a title which undoubtedly stood preferable on the ground of hereditary succession, but which circumstances had rendered it imprudent to urge at an earlier period. Thus much as to the point at issue between the rival parties, which, under the ensigns of a white rose appropriated by the house of York, and a red rose by that of Lancaster, now began to deluge the kingdom with blood.

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The duke of York, a cautious and moderate man, did not at once disclose his intentions, even when his appointment of protector of the kingdom, during an illness of Henry, gave him a favourable opening. His enemies availed themselves of his slowness, and induced Henry, on the appearance of convalescence, to deprive him of that honour, and confer it on the duke of Somerset. In the first battle, which was fought at St Albans, after sundry manœuvres and stratagems on both sides, the king had the misfortune to fall into the hands of Richard, who treated him with great respect, and used his success no farther than to induce that feeble prince to commit the authority of the crown again into his hands, a measure afterwards ratified by parliament. The queen, some time afterwards, got her husband to resume the government, rallied the remains of the Lancastrian party, but was defeated in a battle at Northampton, when Henry was again made prisoner. Richard, still exceeding in caution, now very gently proposed his claims to the House of Peers, who, with some members of the Commons, at last gave a decision intended to please all parties, acknowledging the title of the duke of York, consigning the government to his care during the lifetime of Henry, who was to retain the title and dignity of king, and prescribing his succession on the death of that prince. The moderation of the duke, and the easily managed disposition of Henry, now a prisoner besides, produced acquiescence in this sentence.

But the queen, less inclined to any such compromise, had in the mean time assembled an army, with which she hoped to recover the power of her husband. The duke, taken by surprise, unadvisedly ventured on an engagement at Wakefield, with very inferior numbers, when he was defeated and slain. This might have been expected to terminate the contest between the two parties. But it was far otherwise. The earl of March, son and heir of that nobleman, obtaining some advantages over the earl of Pembroke, one of Margaret's adherents, advanced against her, animated as she was by recent success in another battle at St Alban's, which brought the king again into her hands. She now found it necessary to retreat, therefore, and left her rival a free passage into the capital, where he was well received, and in a short time, by a sort of popular election, and through the predominant influence of the earl of Warwick, commonly called the *King-maker*, proclaimed king, by the title of

Edward IV. A. D. 1461.—This elevation was not to be peaceably enjoyed. Margaret, persevering in her efforts, soon found herself able to raise an army of 60,000 men in the north, with which she resolved to encounter her opponent. Edward, and his chief adviser Warwick, at the head of 40,000, hastened down to Yorkshire. The armies met near Towton, a small village in that county, where one of the most sanguinary battles recorded in the history of England since the conquest was fought. Edward, in whose composition there was little of the "milk of human kindness," had ordered that no quarter should be given; and indeed the parties were so inveterate in their hostility, that such a command was very superfluous, if mutual destruction were the object aimed at. Above 36,000 men are said to have fallen. The victory was decisive on the side of the Yorkists. Margaret and her husband fled into Scotland. She afterwards obtained a small supply of men, with which she ventured again to enter the kingdom. These were defeated at Hexham, when her cause became so utterly desperate that she and her husband were forced to seek their safety in separate flight. The wretched Henry thought to conceal himself in England, but was discovered and carried prisoner to London. Margaret escaped, after some perilous adventures, to the court of her father, where her retainers lived for some time in the greatest indigence.

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Edward, now freed from his enemies, began to indulge in a medley of licentiousness and cruelty, of which there are few parallels. His conduct proving likely to render him unpopular, except among the dissolute and profligate, the earl of Warwick endeavoured to recover him from his vicious excesses, by a proposal of marriage with the Lady Bona of Savoy, but was at last so disgusted and offended at his privately espousing Lady Grey, while he himself was actually engaged in a negociation for effecting that foreign alliance, that he abandoned the king's interest, and entered into a combination against him with the duke of Clarence, Edward's second brother, and several of the nobility, who took alarm at some measures of his administration. Opportunities were not long wanting to call forth the manifestations of their resentment. Plots, conspiracies, stratagems, and insurrections succeeded each other with fearful rapidity. Warwick, forced to flee to the continent, obtained assistance from the king of France, which enabled him to invade the kingdom, and revive the hopes of the Lancastrian party, with whom he had now connected himself. Edward, vainly confiding in his security, was surprised, and with much difficulty escaped into Holland, so affording the enterprising *king-maker* another occasion for the exercise of his creative power. Henry, now released from the tower, was again, by his means, seated on the vacant throne; and a parliament which was summoned gave authority to the change, and busied itself in reversing all that had been done in the preceding reign.

But the process of revolution was not yet completed. Edward, an exile in Holland, procured some forces from the duke of Burgundy. With these and his few followers he landed in Yorkshire, where, though at first he was coolly received, he gradually accumulated an army, which enabled him to march to London, and seize on the person of the unfortunate Henry, who was again conveyed to his old mansion in the tower. The influence of Warwick, beginning to decline, was vastly weakened by the defection of Clarence, who went over to the cause of his brother with a body of 12,000 men. Naturally impatient, accustomed to overcome, and being disinclined to share any eventual success with Margaret, whose arrival was every day expected, this extraordinary character, rejecting the terms of peace which were now offered him by the two brothers, prepared to accept the boon of fortune, by venturing on a battle at Barnet, within ten miles of the capital. This was decisive of his efforts and his life. He

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fought with amazing valour, repeatedly eyed the goal of victory with an emotion more grateful even than hope, but at last perceiving the injurious consequences of a mistake of cognizances, which no art or courage on his part could retrieve, plunged among the thickest of the combatants, and fell.

The unfortunate but magnanimous Margaret, aided by the Duke of Somerset, made a last struggle at Tewkesbury, where she and her son, the prince of Wales, were made prisoners. This youth, heroically, rather than prudently, vindicating his invasion in the presence of Edward, was struck on the mouth by the gauntlet of that prince, which served as an excitement to the dukes of Gloucester and Clarence to butcher him almost on the spot. Henry died a few days after the battle, not without suspicion of the former nobleman's deed, and Margaret herself was ransomed by the king of France, where she terminated her miseries after a few years of privacy.

Edward had now entire leisure, on one hand, to gratify his revenge on his adversaries, by executions and confiscations, and on the other hand to wallow in those pleasures, the indulgence of which, it might seem, constituted his whole idea of royal felicity. The series of his debauchery was a little broken by his short invasion of France, which might be called abortive, if the promise of a sum of money from the king of that country had not given him an exhilarating motive for returning to the arms of his mistresses. To the list of his crimes he added the unjust prosecution of his own brother, the duke of Clarence, whom he had the ingratitude to accuse in person before the House of Peers, and the barbarity to consent to his execution, but not without some regard to the taste of that prince, who being allowed to choose the mode of his death, preferred being drowned in a butt of Malmsey wine!

The remainder of Edward's days presents a wretched picture of depravity and weakness, pompous threatenings against the French monarch, and insignificant performances. He was on the eve of apparently real preparations for a serious attack on Lewis, when he was seized with a disease which terminated his reign in the 42d year of his age. The elder of Edward's two sons, a boy in his thirteenth year, was declared his successor, by the title of

Edward V. A. D. 1483;—but the duke of Gloucester, the late king's brother, was named Protector of the kingdom during the minority. Never was trust more fatally bestowed. That ambitious and blood-thirsty miscreant now instituted a system of the most flagitious villainy ever exhibited among mankind. He fomented the rising dissensions of the old nobility, who had taken umbrage at the queen's additions to the peerage, while, at the same time, by professions of attachment, he won her confidence. Then he gained over the duke of Buckingham and some other lords to aid his scheme of obtaining the guardianship and custody of the young king. Having accomplished this, he next got possession of the king's brother, and, under pretence of preserving them from danger, had them conveyed to the tower. It was now his interest to spread a report of their illegitimacy, and by various means to defer the intended coronation of Edward. But these measures, unprincipled and dishonourable as they were, wrought too slowly for his desires, and too softly for his ferocity. It became expedient to get rid of those persons whose characters and attachment to the royal family pointed them out as obstacles in the way of his ambition. The blood of several noblemen, accordingly, was shed without compunction, and without justifiable cause. He now grew weary of the mask which he had worn for some time, and, after sundry artifices, succeeded in producing something like an appearance of popular election to the throne, which he affected to be equally unable and unwilling to fill.

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Richard III. A. D. 1483.—His first act, after this elevation, was calculated to remove two at least of the rising evils which threatened its security. These were the princes in the tower, whom he procured to be smothered to death and privately buried. Thinking himself now tolerably safe at home, he began to form some foreign alliances, in order to confirm his power; and, by concessions to the clergy, and liberality to his friends, seems to have expected that he should identify his continuance in the government with the interests of those who were able in any degree to promote it.

But danger, as is usual, arose in a quarter to which his attention had been little directed, or which, in the pride of power, he had only beheld to ridicule. Henry, earl of Richmond, the only surviving branch of the house of Lancaster, had long lived an exile, and in all probability without a ray of hope of the prosperity that awaited him. With this prince did Buckingham, now disliked and suspected by Richard, enter into negociations for recovering the throne of his ancestors. That nobleman himself, betrayed before his plot was fully ripe, was not permitted to witness the success of his associate. Henry, soon afterwards landing in England, was obliged to return to Brittany, on hearing of his capture. This induced Richard to take measures for his own safety, quite of a piece with his former practices, but indicative of a pliancy and insinuation of manners of which it would have been thought his savageness was incapable. One proof of this was his overcoming the horror and well founded dislike of the Lady Anne, widow of the young prince of Wales, whom his own hands had murdered at Tewkesbury, and actually persuading her to become his wife!

The earl of Richmond, once more making a descent on England, asserted his claims to the crown. Richard, whose only virtue was courage, hastened to meet him. The respective armies encountered at Bosworth-field, where, after a display of the most determined valour on both sides, fortune declared in favour of Henry, by the fall of his opponent and a decisive victory. The crown which Richard had worn, being found among the slain, was immediately placed on the head of the victor, whom the soldiers now proclaimed king. Thus ended the murderous conflict of the rival houses of York and Lancaster, by the success of Henry.

Henry VII. A. D. 1485, who, by his marriage with Elizabeth, daughter of Edward IV. fortunately united the rights of both families. This itself, and still more certainly in connection with his recent services to the country in freeing it from an odious tyrant, would have proved a sufficient recommendation to the throne. But the jealous temper of Henry, who always disliked the house of York, prompted him to defer the coronation of that princess for two years, by which means he seems to have expected that the priority of his own title would be generally and substantially admitted. The policy of such delay, nevertheless, was very questionable. His reasons for it were so obvious, and his conduct to that princess so ungenerous, as rather to enhance than conciliate the doubts which existed in men's minds, and in all probability gave occasion to those demurrings and appearances of disaffection which so frequently disquieted his reign. Yet the government of this prince, despotic, cold-hearted, severe, and avaricious as he was, proved of singular utility to his country. He had the sagacity, not indeed very marvellous, to discover that the welfare of the people was intimately connected with his own prosperity. His selfishness, therefore, more perhaps than his benevolence, of which there was no mighty portion in his character, suggested many salutary laws for the preservation of a good police; and a similar principle gave rise to several enactments for the promotion of commerce, which, though less commendable from their partaking of the errors in the prevalent theories, or, to use a more appropriate expression, vague notions of political economy of the times, were at least immediately instrumental in augmenting the revenues of the country. In depressing the power of the nobles, which he did very effectually, he was more actuated by the natural propensity to be uncontrolled, than the liberal idea of relieving the community from their grievous pretensions; but it might well be questioned, whether his own arbitrary rule, the imposition of several heavy taxes, and his participation in the profits of some unjustifiable exactions, did not prove more odious and revolting to popular feeling, than all the injurious but not uncourtly bonds of the feudal authority. He maintained peace with foreign powers, more from a personal unwillingness to diminish the contents of his treasury, than a conviction of the general unprofitableness and inexpediency of war; but his caution or parsimony, in this respect, was friendly to the exhausted energies of the kingdom, which could ill have borne the expences of a large military establishment, and the unsatiableness of his own avarice. In a word, the patriotic historian of England, in contemplating the period of the seventh Henry, is much more likely to be impressed with a sense of gratitude for the soundness of constitution which could recover his country from its previous convulsions, and preserve it under its subsequent severity of regimen, than to be animated by any sentiment of admiration or esteem for the individual to whose vigorous and unfeeling governance it was committed. The principal events of this reign may be briefly stated.

An insurrection under some of the leaders of the York faction was speedily subdued by a general offer of pardon, and an accumulation of much more power than what was necessary to quell it. To this succeeded a most daring and improbable imposition, but contrived to keep alive the uneasiness of the king,—the substitution of one Lambert Simnel, a baker's boy, for the Earl of Warwick, son of the duke of Clarence, put to death in a former reign, as already mentioned, whom Richard had confined to the tower, where he now lodged. No small degree of address and activity was required to defeat the consequence of this device, which led to an obstinate battle at Stoke in Nottinghamshire, where the king's forces were decisively victorious. Poor Simnel himself was taken prisoner, and instead of filling a throne, as his adherents anticipated, was content to become one of the meanest appendages on royalty—that of scullion in the king's kitchen! A few years afterwards appeared another impostor in the person of Perkin Warbeck, whose ingenuity and multifarious adventures surpassed the simple narrative of his predecessor. This youth being induced by the old duchess of Burgundy, the implacable opponent of Henry, to personate the duke of York lately murdered in the tower with his brother Edward, was recognised by many of the nobles, and a great part of the people, as the rightful heir of the throne. The delusion spread far and wide, and threatened a general revolt. But the prudence and policy of the king ultimately defeated the malice and audacity of his enemies. Perkin, condemned to perpetual imprisonment, again meditated insurrection, and was put to death; but not before he had drawn the unfortunate Warwick, whose harmlessness and ignorance might have exempted him from the application of "the tyrant's plea," into a snare, which terminated in his conviction of high-treason, and the loss of his head.

This unmerciful treatment of the last and virtually innocent male descendant of the Plantagenet race, caused great discontent among the people, already abundantly disposed to take umbrage at his government. The marriage of prince Arthur, the king's eldest son, and a great favourite of the nation, with the infanta Catharine of Spain, which soon followed, gave a little relaxation to their murmurs. But the speedy death of that prince was a source of deep regret. His widow was shortly afterwards espoused to the second son, Henry, now made prince of Wales, but who reluctantly submitted to his father's will, in entering upon an espousal which it required the pope's dispensation to solemnize.

The remainder of Henry's reign presents, among some unimportant incidents, the continuance or rather aggravation of the public burdens, and the consequent disaffections, fruitless as they were, of the people, and the arrival of the king of Castile in England, whom Henry received with great magnificence, and from whom he obtained the surrender of the earl of Suffolk, one of his refractory subjects, then under the protection of that monarch. Some thoughts of extending his foreign alliances by marriage employed the mind of Henry, when the approach of death filled him with very different and far less agreeable contemplations. Remorse, terror, the struggles of conscience with avarice and pride, and some very futile efforts to purchase peace of mind by bestowing charity and endowing religious houses, sadly diversified his last sufferings. He died at his favourite residence at Richmond, in the 52d year of his age.

Henry VIII. A. D. 1509. The joy testified at the accession of this prince, was compounded pretty equally of thankfulness for relief from the iron rod of his father, and the pleasing expectation of better times under his promising auspices. Nature had been bountiful to his exterior,—a dispensation which never fails to produce an agreeable impression; and the care which had been bestowed on his education, and which was far from being belied by his attainments or his temper, gave ground for anticipating at least a gracious and a liberal, if not a wise and a prosperous reign. Some of his earliest measures ratified the public opinion, but were rather more manifestly directed to acquire it than can be commended by a rigid moralist. A rupture with France revived the foolish notion of subduing that kingdom, which had formerly deluded and impoverished the nation; but it disclosed the frivolity and puny cast of Henry's mind, and ended in a truce which afforded him a more congenial season for the developement and indulgence of his rising follies. A war with Scotland, which afterwards took place, was more glorious to his arms,—the earl of Surrey gaining a complete and decisive victory over the king of that country, who fell with the chief of his nobility on the bloody field of Flodden. But this success only encouraged him to prosecute a system of unprofitable enterprises and ruinous expenditure. The treasure which his father had left was now dissipated, and some ingenuity was needed to supply its place. Here he had the very adequate assistance of his chief adviser, Cardinal Wolsey, a man who, from very insignificant beginnings, advanced to the highest honours of the state, and the possession of more wealth and influence than had ever before been realized by an English subject. The particulars of his rise, eventful predominance, and degradation, which so much diversify, but at the same time render disgusting, the reign of Henry, will be elsewhere given.

The financial operations of this crafty minister gave great offence to all classes of the community, and, in short, had the effect of converting the government of his master into a hateful despotism. A spirit of insurrection manifested itself, which the most prompt exertions, and some nominal rather than real concessions, at last allayed. This a little abated the sway of the cardinal over the king, but, at the same time, exercised his cunning. Even this, however, acute and venturous as it was, failed to guide him through the difficulties which royal passion occasioned, and which ultimately accomplished his ruin. To the same cause must, in a great degree, be ascribed another revolution which now commenced, and which was much more important and more singular than the subversion and overthrow of a favourite.

After a marriage of eighteen years with Catharine, his brother's widow, who had in that time borne him three children, and whom he continued publicly to respect, though he made no scruple of conjoining a multitude of mistresses in his affections, Henry became enamoured of a young lady of extraordinary beauty, but of such virtuous principles as effectually resisted all his solicitations to illicit enjoyment. There remained nothing for a monarch whose licentiousness had experienced no controul, and could brook no disappointment, but a divorce from his wife, which might enable him to gratify his love by sharing his crown with the object that inspired it. His scrupulous conscience, now no longer at rest in a connection which had always been viewed as approaching to incest, if not actually its completion, and which many reasons had already urged him to break off, was now unburthened to his confessor, the bishop of Lincoln, and afterwards made patent to all the bishops in the kingdom. These, with one exception, declared the marriage unlawful, an opinion which Wolsey himself was not backward to affirm. Application to the pope for a divorce followed in due order, and was promised to be favourably answered. But the necessity which the pontiff happened soon to be under of conciliating the emperor Charles V. the nephew of Catharine, subsequently impeded the dispensation promised. Various contrivances were accordingly employed to divert the English king from his purpose, but without effect. The evasions and dilatoriness of the pope were met, on the part of Henry, with a good deal of positiveness, many arguments drawn from scripture, and even something like a threatening of separation from his ecclesiastical dominion, in the event of refusal. The crisis exceeded the politics of Wolsey, who was no less perplexed than the pope between the contending interests by which he was assailed, and whose trivial and unmanly temporising found at last a vindictive censor in his royal master. By the advice of archbishop Cranmer, who now acquired the king's confidence, and whose attachment to the opinions of Martin Luther, which at this time effected such mighty changes, was already well known, the case of the wished-for divorce was submitted to the judgment of all the learned universities of Europe. On their general concurrence as to its illegality, the marriage was annulled by the same prelate, and shortly afterwards the repudiated queen gave place to the exalted Anne Boleyn. The pope, not yet fully aware, perhaps, of the consequences of his wavering conduct, condemned the sentence of Cranmer. But the king had gone too far to retract, and, willing enough, it seems, to shake off the trammels of Rome, proclaimed himself head of the church of England. Parliament concurred in his resolution, ratified his newly assumed title, and abolished the papal authority throughout the kingdom. The bulk of the people, who had been gradually prepared for such a revolution, joyfully beheld these measures, and the subsequent demolition of monasteries, and other ecclesiastical establishments, by which an immense revenue accrued to the crown.

But though the king had thus abandoned the controul of Rome, he had not in any measure relinquished the creed of the church, or espoused the sentiments of the reformation. It is probable that he still chose to flatter himself with the title of Defender of the Faith, which had been some time before conferred on him by the pope, in testimony of satisfaction at the support he had given to the Romish doctrines, by the publication of a work maintaining the seven sacraments against the opinions of Luther. Nothing could be more inconsistent and unreasonable than the conduct which he now displayed in matters of a religious nature, or more harassing to such of his subjects as were conscientiously attached to either of the rival systems which claimed their devout regard. No wonder, then, that, among the events of this period, so decidedly affected by the violence and despotic behaviour of the monarch, we are struck with the martyrdom of persons holding very different religious persuasions. The motley character of Henry's court was a fit sample of the discordant opinions which prevailed among the people. The queen was an advocate for the new doctrines; Cromwell, the able and faithful servant of Wolsey, now in the king's confidence, had embraced the same views, which he cautiously but powerfully promoted by his various and extensive influence. The archbishop of Canterbury, also high in favour, was no less warmly attached to this cause. On the other hand, the duke of Norfolk, who had great authority in the council, and Gardiner, bishop of Winchester, an artful and insinuating man, were firm adherents to the old system. Among those who suffered about this time were Bainham and Bilney, who had favoured the doctrines of Luther, and Fisher, bishop of Rochester, and the illustrious Sir Thomas More, neither of whom could be induced to acknowledge the king's supremacy. The destruction of the queen herself, which soon afterwards occurred, is in part imputable to the enmity which her heretical sentiments excited in the disciples of the Romish church. But its more ostensible cause was, her having the double misfortune of surviving the passionate fondness of the king, and her innocently incurring the suspicion that her affections were otherwise directed. Nothing could be more inhuman and detestable than the treatment which she received from this libidinous and tyrannical sensualist. The very next day after the execution of Anne Boleyn, the unfeeling and profligate Henry married the Lady Jane Seymour, who had now engaged his capricious fancy,—an excess of brutal and unmitigable appetite, which may be well allowed as an ample apology, were there no other defence, in behalf of that murdered beauty. It is impossible to relate this transaction, without, at the same time, holding up to contempt the language and the proceedings of the parliament which sanctioned such infamous behaviour. The speaker become perfectly eloquent on so fair a subject as the royal graces and accomplishments, compared his majesty to Solomon, to Sampson, and to Absalom, for the respective virtues in which they excelled; and the parliament, in addition to other proofs of base subserviency, ratified the divorce from Anne Boleyn, whose issue, as well as that of the former queen, they declared illegitimate, assigning as a reason why they annulled the marriage, " for that his highness had chosen to wife the excellent and virtuous Lady Jane, who, for her convenient years, excellent beauty, and pureness of flesh and blood, would be apt, God willing, to conceive issue by his highness."

The various innovations and barbarities which Henry practised, naturally produced murmurs and insurrections among the people. But the former were disregarded, and the latter were readily subdued. The king, in reality, had acquired a power and an agency over the minds of the chief nobility and leading characters, by his distribution of the treasures obtained from the dissolution of monasteries, &c. which set him quite above any serious apprehensions of discontent and tumult in the lower ranks of life, aided, as they sometimes were, by several persons of more exalted stations. On these latter he never failed to inflict a vengeance which no intreaty could mitigate, and scarcely any event, however joyful or melancholy, so much as retard. Thus, the birth of a son, afterwards Edward VI. and the death of the queen, two days after delivery, made but a short pause in the summary treatment of those who, in any measure, rebelled against his authority.

Henry remained a widower above two years after her decease, but not without repeated endeavours to obtain a proper successor. This period, indeed, appears to have found him very sufficient employment in the numerous trials and executions which called forth his theological talents and zeal, and by which he thought to promote religious unanimity and concord among his subjects. Alas! the fire and faggot are miserable substitutes for virtuous behaviour and a kind conciliatory disposition, which alone can recommend a practical system to the esteem of mankind. But of this truth neither the king, nor the gerality of those under him, who swayed the affairs of these and subsequent times, entertained any beneficial conviction. It is easier by far to burn a man for his opinions than rationally disprove them, or shew their inferiority by greater purity of character, and more benevolence and self-denial, than they are capable of producing. The case of one Nicolson, or Lambert, is among the most remarkable exhibited in the dismal catalogue of Henry's attempts at conversion. This person, a schoolmaster in London, entertaining and promulgating an opinion not in unison with the established doctrine, concerning the real presence in the bread and wine of the Lord's supper, was cited before the prelates Cranmer and Latimer, themselves adherents in part to the system of Luther, and by them endeavoured to be brought over to the standard of orthodoxy. But, instead of yielding to their reasonings and advice, he chose to appeal to the king. Henry, vain of his polemical prowess, was not displeased to be favoured with such an opportunity of displaying his learning and logic. All this had been very well, if a determination by any and all means to get the better in the disputation had not prompted him to employ a sort of argument in which he was sure to excel any controvertist in the kingdom. Public notice was given of his royal intention to enter the lists with the schoolmaster; and suitable accommodations were made in Westminster-hall for the purpose. What preparation in the way of study the king underwent does not appear; but it is certain, that on the day appointed he came sufficiently apparelled and accompanied to convince any man in his sober senses, that it would be highly hazardous to dispute with him. Poor Lambert, without a single individual to espouse his cause, or instruct him how to act on so trying an occasion, was called on, in face of royalty, supported by all the prelates, peers, judges, and lawyers of the land, to defend his opinions against the arguments by which they were condemned, or to abandon them, on pain of incurring the vengeance of the law. After some compliments, with which the schoolmaster thought proper to preface his reply, and which were indignantly spurned, the king urged a few arguments against his opponent. These were enthusiastically applauded by the audience, who had already decided the question in favour of royalty. A succession of bishops following up the blow, which had itself proved efficacious enough to astonish the delinquent, poured in such proofs and rhetoric as left him absolutely stupified, mute, and motionless. He was far, however, from being convinced; and, summoning up courage, when the king proposed to him the question, "Whether he would recant his errors or die for his obstinacy?" answered, that he cast himself entirely on his majesty's clemency; and on the reply being made to this, that his majesty "would never protect a heretic," which was followed by reading the sentence of condemnation, prepared, with unshaken fortitude, to encounter the shocking sufferings and horrible death now decreed against him. This victory was so flattering to the king, and gave such strength to all the other arguments by which his creed was defended, that he appears henceforth to have resolved more vigorously than ever to punish the infatuated creatures who could presume to differ in opinion from him.

In the midst of the diabolical barbarities which testified the intolerance of the times, Henry determined to take another wife. The lady now pointed out as quite suitable to his taste, and eligible from her German connections, was Anne of Cleves. In this personage, however, notwithstanding her size, which was large enough to match well with his own immensity of carcase, he was grievously disappointed, though, for reasons of state, he was obliged to marry her. His disgust increased on farther acquaintance; and Cromwell, who had recommended the match, afterwards struggled very unsuccessfully with his altered regard, which at last vented itself in signing the death-warrant of that favourite. From the new queen, Henry speedily obtained a divorce on very curious grounds. But the parliament, as usual, was quite agreeable to his wishes; and the lady herself, an example of uncommon moderation and insensibility, perhaps also moved by very politic reasons, perfectly and heartily concurred in the separation. He was now at liberty to seek another partner, whom he speedily found in the person of Catharine Howard, niece to the duke of Norfolk. This connection gave just cause for apprehension to the protestants, at least for sometime, her family and friends being zealously attached to the Romish faith. But the king's joy in this marriage, which had every appearance of sincerity, did not continue long. An unexpected accusation of her infidelity to the marriage-bed, resting on very alarming evidence, and a just conviction, at all events, of her previous incontinency, roused the indignation and wounded the pride of the king. Sentence of death, his usual remedy, followed, and left him again a widower. After this lamentable exposure, a most extraordinary act was passed, in which, among other things, it was declared high-treason for any woman, not a virgin, but supposed such, to marry the king. It resulted from this absurd decree, that any frail maid, who had the misfortune to be courted by him, was reduced to the painful necessity of either disclosing her shame, and so ruining her fortune, or incurring the risk of her head by hazarding a discovery after marriage. This monstrous clause occasioned no small merriment among the people, who said, wisely enough, that the king must henceforth look out for a widow, as no reputed maid would ever be induced to incur the penalty of the law. It is a little singular, that Henry appears actually to have proceeded on this suggestion, by taking, for his sixth and last wife, Catharine Parr, widow of the late Lord Latimer, who had the good fortune to survive him, but not without incurring his displeasure, by a pertinacity in disputation on theological subjects, which at one time had like to have exposed her to the awful hazards of impeachment.

The latter days of Henry were marked by no relenting condescensions or gleams of benevolence, which could soften down the memory of his former cruelties. Rendered odious by an unwieldy and bloated body, a morose and gloomy air, and become irascible by infirmities and disease, he seems to have revenged himself for the disgust and uneasiness which he occasioned, by the savage delight of shedding blood, and that too, sometimes, of those whose services had merited reward, or whose age and sex ought to have called forth mercy, as if, by exciting terror, he could produce respect, and as if he imagined that his attendants, escaping the severity of his wrath, would be prompted by gratitude to entertain affection. The whole weight of his iniquity, indeed, ought not to be charged on himself. A nobility that could crouch to such a monster, and a parliament that, affecting to represent the mind and feeling of the nation, could vilely mould itself into the pander for his lusts, and the approver of his murders, were implicated to the full amount of their tolerance and depravity in the guilt and misery of his reign. But it has been noticed among the singularities of their history, that, while the English have generally proved abundantly submissive to their tyrants and oppressors, they have shewn themselves insolent enough and ungrateful towards those princes whose mildness and virtues ought to have nherited their love and esteem. Henry's health rapidly declined; but his courtiers, afraid of his violence, which became more and more outrageous as he approached his end, durst not inform him of his dying condition. At last one of them ventured to communicate to him the impression which his appearance excited, and to exhort him to prepare for the final change which was so near at hand. The king expressed his resignation, and desired to see Cranmer, but became speechless before that prelate arrived. He died in the 56th year of his age.

Edward VI. A. D. 1547.—The vanity of Henry projected a continuance of his authority after death. For this purpose he imposed various regulations, and appointed a council of sixteen persons, by which the concerns of the government were to be carried on during the minority of his son, now only nine years old, but whose majority, by a clause also in his will, he had fixed at the completion of his eighteenth year. But the first act of the executors, now no longer in dread, was calculated to defeat his aim.

They chose the earl of Hertford, afterwards duke of Somerset, uncle to the young prince, protector of the realm; lodged the regal power in him, and granted him the privilege of nominating his own privy council. The only opposer of this important measure was the lord chancellor Wriothesley, a man of an ambitious and haughty mind, who discovered in it the establishment of an authority that would materially interfere with his own views.

The protector merited the confidence thus reposed in him; and being strongly inclined to the new religion, which he could now with some degree of safety profess, declared his intention of rectifying the abuses of the old system,—a symptom which the protestants hailed as promise of the most beneficial changes. A great share of popularity was the natural consequence of his conciliatory and courteous behaviour; and the advice of Cranmer, to which he had recourse in all matters concerning religion, at that period the most interesting topic in political economy, gave a satisfaction, which was no less the result of affection for that distinguished prelate, than a conviction of its substantial wisdom. There were not wanting some persons, indeed, who anticipated and wished a much more radical revolution in religion than what Cranmer projected or advised. To them, in the fervour and brilliancy of evidence with which the new doctrines had taken possession both of their judgments and feelings, it appeared superfluous, if not profane, to prescribe any ritual for devotion, or to attempt the guidance and confinement of the imagination by visible emblems and bodily observances; nor, in their spiritual conceptions, did either the temporal power or the gorgeous appendages of a costly establishment comport with the early history, the celestial, not worldly pretensions, and the transcendental efficacy of revelation. But Cranmer, contemplating, no doubt, the characters and tastes of the bulk of mankind, who are more influenced by fashion than by reason, and to whom the existence and the claims of abstract truth are as mere nonentities, unknown and disregarded, appears to have meditated an institution, which, while it never could shock the understanding of the intelligent, might present every requisite assistance to the weakness of piety, and even by furnishing an innocent gratification to the senses, operate as at least an occasional substitute for the allurements of vice. His object, therefore, was to reform, not to subvert,—to apply, with a discriminating judgment, the pruning knife to the venerable, but rank vine, which shed a baneful gloom over the land,—not with one rash thrust of the plough to level it with the refuse of the dunghill; and it is now for the voice of candour, at the distance of two centuries and a half, to declare, whether any national establishment of religion has yielded fairer and more abundant fruit, or conjoins more enlightened doctrine with greater dignity of character and wider capabilities of utility and comfort.

The chief opponent to the graduated reformation thus projected, was Gardiner, bishop of Winchester, whose conduct excited the indignation of the council, by whom he was at last committed to the Fleet. Bonner, bishop of London, received a like sentence, but was less tenacious of his opinions; and Tonstal, bishop of Durham, who objected to the new regulations, was dismissed the council. Some delay occurred in accomplishing the change, in consequence of a rupture with Scotland, which required the personal exertions of the protector in that kingdom. These were eminently successful in a decisive victory on the field of Pinkey, near Musselburgh. This expedition procured popular applause for the protector, but rather raised the envy of several of the nobility, some demonstrations of which, together with the insidious practices of his own brother, Lord Thomas Seymour, a turbulent and artful man, compelled him to return home, before he had reaped all the advantages likely to accrue from it. This nobleman, whose talents were supposed superior to his brother's, had, by his address and insinuation, attracted the regards of the queen-dowager and obtained her hand,—a connection which increased his influence, and rendered him still more formidable to the protector. Not satisfied with a new patent for admiral, and an additional appointment, he induced the young king to apply to parliament to nominate him his governor, and, in a multitude of ways, contrived to engage the principal nobility on his side, and thus disturbed the peace of the government. The menaces of the council scarcely restrained his pertinacity and caballing; and even the death of his spouse, so far from repressing his ambition, afforded him rather a new incitement, by raising his hopes of gaining the affections of the princess Elizabeth, afterwards queen, to whom he now made his addresses. That lady seems to have listened to him with a favourable ear. But as her father, the late king, had excluded his daughters from the succession in the event of their marrying without the consent of the executors, which it was unlikely, if not impossible, that Seymour should obtain, it was presumed that he aimed at regal authority by means of the highest injustice and atrocity. The protector, fully aware of the dangerous machinations of his brother, endeavoured, by a variety of expedients, to defeat or prevent his projects. On their failure, he was persuaded by Dudley, earl of Warwick, a wicked and artful man, who, at this time, was plotting his own rise by the ruin of the two brothers, to employ against him the extent of the authority with which he was invested. At his suggestion, Seymour was sent to the Tower; a bill of attainder was afterwards preferred against him; and on the concurrence of parliament, without any formal trial, the sentence of death was put in execution. This severity was very disagreeable to the nation, and brought the protector under no small odium. He recovered his popularity in great degree by endeavouring to relieve the distresses of the community, which had arisen from various causes, and at last broke out into insurrection. But the augmenting influence of Warwick now threatened his destruction, by forming a party in the council, resolute on freeing themselves from his controul. In reality, he had excited the envy and hatred of the nobility in general by his superior magnificence and power, and his efforts in favour of the popular interest. Every opportunity was accordingly taken to expose his errors, and hold him up as the author of the public calamities. Warwick, assuming consequence as he saw his plans ripening into effect, witnessed the accumulating difficulties of the protector with pleasure, as the harbingers of his own elevation, and, from one step to another, at last arrived at supremacy of power. The protector, arraigned on sundry charges, not exactly amounting to high treason, for a time eluded the blow which was aimed at him, by a humble confession before the council. He was deprived, indeed, of his offices, and a heavy fine was imposed on his estate. But this was remitted by the kindness of the king, and he shortly afterwards was re-admitted to the council. His fate, however, fast hastened, very greatly owing to his own imprudence in throwing out invectives against his enemy, now created duke of Northumberland. A project for murdering that nobleman, in which he engaged, was discovered, and formed one of the articles by which he was again impeached. This crime had been made felony in the reign of Henry VII. and Somerset was accordingly condemned. His execution was peculiarly distressing to the people, by whom, notwithstanding sundry faults, which, if not of a very aggravated nature, are apt to be forgotten on such occasions, he had always been regarded with kindness. Many rushed in to obtain some of his blood on their handkerchiefs as a precious relic; and which some afterwards upbraidingly displayed in the eyes of Northumberland, when about to suffer a similar death.

The infirm condition of the king's health advanced the ambitious views of that nobleman. Contemplating, if not in reality, as has been suspected, meditating the death of Edward, whose constitution appears to have been naturally delicate, he laboured to alter the succession to the crown, to the prejudice of the two sisters Mary and Elizabeth, and the Queen of Scots, in favour of the Marchioness of Dorset, or rather her next heir the Lady Jane Grey, to whom he had married his fourth son, the Lord Guilford Dudley. The king, persuaded by his reasonings, at last gave consent to the projected arrangement, and directed the judges to draw up letters-patent for the purpose. Their demurs and objections were submitted to the council, and finally overcome by the king's granting pardon for what they should draw up, when the measure was completed. After this the king grew gradually worse, and his physicians having been dismissed by Northumberland's advice, he was put under the care of a female empiric, by whose treatment his complaints were so much aggravated as to assume an alarming aspect. He died at Greenwich in the sixteenth year of his age, regretted by the people, who had flattered themselves that his amiable and virtuous character would secure a happy reign.

Mary, A. D. 1553.—This princess was in the country when her brother died, which gave Northumberland an opportunity to put in force the deed alluded to, by proclaiming the lady Jane Grey queen of England, an honour which she reluctantly received, and which she possessed for no longer a period than ten days. Mary having written to the council demanding her right, received an insolent answer, informing her that she had been declared illegitimate by parliament, and had consequently no title to the throne. This reply was undoubtedly instigated by Northumberland, to whom the council was in some measure under the necessity of at least feigning compliance. But the pretensions of this princess were so obviously superior to those of Lady Jane Grey, that she soon found herself at the head of a party sufficiently powerful to contend in her behalf, with the highest probability of success, whilst to her rival, if one so unassuming and reluctant merit the name, all the efforts of her most anxious advocates could procure only a few adherents, and scarcely any audible expression of allegiance, except from those who had no power or will of their own. Whenever an opportunity was allowed, by the departure of Northumberland to head the troops which he had levied, the council declared against him, and their voice was almost instantly joined by the mayor, aldermen, and city of London. Mary's claims were now irresistible, being supported by 40,000 men, whereas Northumberland had but a handful, and even these far from being confirmed in their resistance. Lady Jane herself, perceiving the total failure of her cause, retired with her mother to a private life. Nor was it long before that nobleman, ensnared in his own toils, and utterly deserted when on the brink of ruin, attempted, by the meanest dissimulation, to commend himself to the very person whom it had been his most manifest solicitude to defraud and oppose. But this base duplicity did not succeed. He was arrested, committed to the tower, tried, and executed. There suffered with him only two persons,—certainly an instance of moderation in punishing so high an offence. Sentence, indeed, was also passed on Lady Jane and her husband; but apparently there existed no intention on the part of Mary to put them to death, till the imprudence of that unfortunate woman's father, the duke of Suffolk, in taking an active part in a rebellion, drew down the fatal vengeance of the queen. Of their innocence it is almost as impossible to doubt, as it is to deny that their tender years, and the temptation and influence to which they were exposed, ought to have pleaded effectually for their pardon. But, alas! theirs was by no means the only blood shed in this calamitous and soul-appalling reign, in defiance of all the claims of humanity, mercy, and truth.

The ardent attachment of Mary to the Catholic faith was long and universally known,—a circumstance which occasioned no small uneasiness to the protestants, and readily accounts for the wishes, at least of many, that the succession could have been legally and efficiently secured on another. Some of the earliest espousers of her claims had conditioned for, and actually obtained, her promise for the continuance of religion in the same state in which she found it. But it was their unhappiness to witness the violation of her engagement, and the adoption of a system of coercion and terror, which disregarded justice, and arrogated the prerogative of the Almighty. She resolved by every means, except mercy and gentle persuasion, to bring the people to her own sentiments on religion, and to restore the full influence and despotic authority of the ancient faith. It soon became apparent, notwithstanding her duplicity and prevarication, that she was bent on undoing every thing that had been done by the reformers, and that in place of a toleration, which she still pretended to hold out, the most rigorous appearance of unanimity would be exacted.

The first serious alarm given to the protestants was the harsh treatment of Cranmer, the exemplar and bulwark of their cause. Having repelled an aspersion that he meant, in compliment to majesty, to officiate in the Latin service, he incurred the resentment of the queen, who had him cast into prison, tried, and convicted of high-treason, for formerly concurring with the council in favour of Lady Jane Grey, though the sentence was not then executed, as she appears to have meditated for him a more awful death. Shortly after this step and some other indications of her bigotry, many foreigners who were attached to the reformation, thought proper to leave a country which they perceived to be threatened with persecution. Their foresight was confirmed by an act of parliament, which, following up the queen's intentions, repealed all the statutes of her predecessor respecting religion, and re-established matters on the same foundation on which they stood at the death of her father.

During these preparatory measures, the ministry were engaged in providing a husband for Mary. The individual on whom they ultimately decided, was Philip of Spain, son of Charles V. whose intolerable spirit, haughty deportment, and unfeeling heart, did ample justice to their notions of congruity. A more detestable couple never wielded an iron rod over a prostrate kingdom. The match was highly disagreeable to the people in general, who anticipated nothing less than that their country would become a mere province of a foreign power. Even many catholics objected to it, and an insurrection, which was headed by a gentleman of that persuasion, bore at one time an alarming aspect. But the protestants had most reason to complain, and soon learned that their fears were not unfounded. Philip, whose fastidious taste nauseated the fulsome fondness, and barely tolerated the disagreeable person of his consort, cordially joined with her in abhorrence of their principles, and a determination to extirpate them. They listened with eagerness to the harsh suggestions of the temporising bishop Gardiner, in opposition to the humane and liberal advice of cardinal Pole, a man whose conscientious regard to the Romish faith, under several aspersions and difficulties, no less demonstrated the firmness of his character, than his good sense and learning reflected light on the age in which he lived. But even Gardiner had the sagacity or cunning to avoid being the visible and busied agent in the work of persecution which now commenced. He found a ready substitute in Bonner, bishop of London, one of those indescribable monsters whom the will of heaven permits occasionally to trample over humanity, as a terrifying sample of the infernal progeny. After a trial of the agency of burning, on Hooper, bishop of Gloucester, and three clergymen of the names of Rogers, Saunders, and Taylor, without the salutary effect of conversion, or the deterring many more from the like offence, he devolved on that furious creature the management of those flames which have so horribly blazoned this period of English history.

Neither amiable feeling nor justifiable curiosity can be gratified by a recital of the atrocities now committed under the semblance of regard to religion, and a tender concern for mens souls. Suffice it to mention, that during a course of three years, in which this mode of reclaiming heretics was practised, the number of those who suffered at the stake amounted to 279. Of these, five were bishops, twenty-one clergymen, eight lay-gentlemen, eighty-four tradesmen, one hundred husbandmen, servants, and labourers, fifty-five women, and four children. Such persecution, in addition to numberless fines and confiscations, besides proving utterly abortive as to the alleged purpose for which it was employed, became so odious to the nation, that the perpetrators and designers were fain to shift the blame from one another, and to screen themselves under various pretences. Nor did the temporal concerns of the kingdom go on more prosperously.

For some time, Mary flattered herself with the prospect of an heir to the crown in direct line; the fortunate event was hastily communicated to foreign courts, and occasioned great rejoicings and many prayers at home; and Philip appears to have artfully kept up the belief, in the hopes of supporting and augmenting his authority, But time at length disclosed the delusion, and the queen's increase of size was found to be owing to a dropsical affection. The mistake, by giving occasion to an improper treatment, accelerated her dissolution. The absence of her husband, on whom she doated, and who had abandoned the kingdom in disgust, was a source of continual fretfulness to her; an unsuccessful war with France mortified her pride in an extreme degree; she was conscious of being hated by her subjects, and could not endure to think that she should be succeeded by her sister Elizabeth, whom she had always disliked, and long wished to find a fit opportunity to destroy. These and other disquieting causes threw her into a fever, which, mercifully for England, terminated her life and short reign in the 43d year of her age.

Elizabeth, A. D. 1558.—This princess came to the throne, not only without opposition, although there were other persons who might claim it, and she herself had been formerly declared illegitimate, but with very general demonstrations of satisfaction. The conduct and character of her predecessor, however calculated to suit the prejudices of some individuals, were pretty universally offensive, and the nation appeared anxious and hopeful for the accession of one who had given many evidences of superior prudence, and whose long discipline in the school of adversity was warrant for the opinion, that she could scarcely be destitute of sympathy for the afflicted. To excellent natural talents, and a sagacious and resolute mind, she had conjoined a large share of learning, almost the only employment in which it was safe for her to engage during the critical times of the former reigns, and the habit of controuling her inclinations and concealing her sentiments, the natural effect of perpetual vigilance among innumerable difficulties, and which, though perhaps not very amiable in private life, is certainly to be esteemed for its rarity and usefulness in a sovereign. She was scarcely proclaimed queen, when Philip, the husband of her late sister, by his ambassador, made her proposals of marriage, to which she returned an obliging but evasive answer. That prince had always professed the highest opinion of Elizabeth, who, again, never could bring herself to acknowledge it, by entertaining a similar impression in his favour, and in whose peculiar constitution or temper, besides, there existed an insuperable aversion to a change of condition, which has never been thoroughly understood. That she was capable of ardent affection for the other sex, is decided by her history; but whether bodily defect, pride of independence, or, which is more probable, a propensity to have many lovers, prevented her from ennobling any individual by the surrender of her hand, is extremely uncertain.

Elizabeth early purposed to reform the church, and, immediately after assuming the reins of government, set about that task, but not without the deliberation and caution which characterised most of her actions. By the advice of sir William Cecil, secretary of state, she recalled the exiles, and liberated those who were imprisoned on account of their religion. She then prohibited preaching without a licence; ordered a great part of the service to be delivered in the native tongue, and forbade the elevation of the host in her presence,—measures altogether indicating a resolution to abandon the established system. Parliament concurred in her views, and in one session the whole form of religion was modelled to the present standard. Some opposition was occasionally given to the successive changes, but it was insignificant; and in proof of the readiness with which they were accomplished, it has been remarked, that out of more than nine thousand beneficed clergymen, only about one hundred and eighty chose to retain their faith by the sacrifice of their preferments.

Such a radical and decisive preference to the protestant cause made all the catholic princes of Europe either the open or the secret enemies of Elizabeth; and Philip himself, perceiving an end of all his hopes with respect to her, made a separate treaty with France, which induced her shortly afterwards to conclude a peace with the same power. She was now without an ally, or any foreign friends who could prove serviceable to her. It behoved her more carefully, therefore, to husband her natural resources, and study to secure the affections of her subjects, by conscientiously and diligently promoting their happiness and prosperity. It is due to the memory of this spirited princess, to declare, that her labours were crowned with success; and that, notwithstanding her despotic principles of government, and disregard to the privileges of parliament, and certain political liberties of the people, England attained most rapidly, under her dominion, to a very exalted pitch of splendour and power. It is certain, in a word, that she was sincerely and actively desirous of the welfare of the kingdom; but it is equally so, that she conceived and wished it rather to emanate from her own authority and wise administration, than to be at all dependent on the natural and healthy functions of a popular constitution. Much of the glory of her reign was owing to her possessing very able ministers, and much of her excellence consisted in a disposition to profit by their sagacity.

But it was the misfortune of Elizabeth, for all things human and all the virtues of man are imperfect, to be defective in that generosity of temper and kindliness of heart which are essential to an amiable character, and which often of themselves, without great talent, lead to commendable, because beneficent conduct. Her interference in the troubles of the sister-kingdom, and her injurious behaviour to her cousin Mary, the beautiful and unfortunate queen of Scots, have left a stain on her memory, which the impartial historian finds it impossible to obliterate. Some of the particulars of the transaction belong to another section,—others may be given here.

The dissensions and animosity which had taken place among the Scots, on the subject of religion, afforded Elizabeth an opportunity of fomenting a faction against that princess, who had incurred her resentment by quartering the arms of England, to which she certainly had well-grounded pretensions, as representative of Margaret, the eldest daughter of Henry VII. married to James IV. king of Scotland. Mary was prompted to this imprudent assumption by her maternal uncles the Guises. But the offence which it gave being more trivial than formidable, would probably have occasioned little thought to Elizabeth, firmly seated on the throne as she was by the decision of parliament and the affections of the people, had not some pretence been necessary to cloak her encouragement of the Scots reformers, who looked up to her for assistance against their natural sovereign, and who were obstinately bent on the destruction of the ancient superstition. Scotland, in reality, was the spot on which the partisans of Mary's claim could be most conveniently assembled, and where, of course, it was safest for Elizabeth to oppose them in the very commencement of their career, and while she had the support and countenance of so energetic a party united against them on a separate plea.

But it must not be imagined, that the personal feelings of Elizabeth alone, or even chiefly, instigated her to the policy which she now adopted. It was the suggestion of her council, and more especially of Cecil, who represented the former, and the eventual mischief to England from an union between France and the sister kingdom, and the dangers which might result from the ambition, and talents, and power of the Guises, engaged on the side of even the doubtful title of their relative. Nothing could be more obvious than the consideration, that the French, once firmly established in Scotland on the ruin of the protestants, would be much more likely to give trouble, though not, perhaps, fatal injury to her kingdom, than when the natural barrier of the ocean still presented a favourite field for the display of English valour. The queen resolved, in spite of her usual economy, to send both a fleet and an army to retrieve the drooping affairs of the Congregation, as the leaders of the Scots reformers had designated themselves; with whom she concluded a treaty of mutual defence, which was to last during the marriage of Mary with Francis, and for a year after; and by which she engaged never to cease her operations till the French were forced out of their country.

The death of Mary of Guise, queen-regent of Scotland, which took place soon after the arrival of Elizabeth's supplies, and before much blood had been shed in the contest, prepared the way for a capitulation; by which it was agreed, that the French should evacuate the kingdom; that the king and queen of France and Scotland should abstain from bearing the arms, or taking the title of England, and that further satisfaction for the injury already done in that respect should be given to Elizabeth; to which were added some concessions in favour of the Scots, including an amnesty for past offences. Elizabeth took care to put one important part of this treaty into execution, by furnishing ships for the removal of the French to their own country. So far, then, her conduct might perhaps seem to be justifiable, at least on those maxims of state-expediency which almost every nation has at one time or other put in practice, in order to guard against a probable or imminent danger. Strict morality, indeed, will rebut the plea of self-defence in this case; because, besides premeditatedly aiding, if not actually exciting sedition, or a rebellious spirit among the subjects of a foreign power, Elizabeth instituted a system of aggression, on the mere surmise, before the receipt of injury, for it is absurd to speak of the heraldic umbrage, and without those formalities which the dignity and awful consequences of national disputes require; nay, which is an aggravation of no ordinary import, in defiance of a conciliatory offer on the part of France, the only power from which she could possibly entertain the slightest apprehensions. But subsequent events, however they were viewed by her jealousy, and however they have been construed by her warmest admirers, will leave no doubt, on the unbiassed mind, of the malignity of her disposition, and the calculating selfishness of her politics.

Mary, the loveliest woman of her time, reared amid the gaieties and gallantry of the most splendid court in Europe, now in the nineteenth year of her age, and already a widow, prepared, not long after the death of her mother, to return to her native country, a striking contrast in almost every thing to the scenes in which her life had been passed, and rendered no way more agreeable to her imagination by recent events, and the general enthusiasm in behalf of a religion always held out to her as a pernicious and damnable heresy. She had hitherto, both during her husband's life and since his death, declined gratifying Elizabeth by acceding to the treaty of Edinburgh, already alluded to, and more especially, through the influence of the same family, refused any formal renunciation of her pretensions, although she had abandoned the visible ensign by which they were supposed to be displayed. Elizabeth, in retaliation, when applied to for a safe conduct, in case she should be obliged to pass through England, on her way to her own kingdom, refused the favour, saying, that till Mary had given satisfaction by ratifying the treaty, she need expect no obligation in return. At this uncourteous denial of a polite but really unimportant request, Mary made no scruple of expressing her indignation, during a very spirited reply to Throgmorton, the English ambassador, by whom it was communicated. Some of her remarks on that occasion shew a perfect understanding of her cousin's character and political views; though she was cautious at the same time to express not only her readiness but her desire to be on good terms with that princess, and not a little commends herself for her moderation, and even good offices, in their intercourse. But a faithful report of this speech, notwithstanding some obliging terms, could not fail to augment the dislike of the imperious and haughty Elizabeth, who had the mean and vindictive cunning to equip a fleet, under the pretence of pursuing pirates, but which was dispatched to take her rival prisoner on the voyage, though without success, in consequence of the occurrence of a fog, which enabled Mary to escape unperceived, and arrive safely in Scotland.

But the snares of the English queen were by no means confined to the sea, or directed to the mere possession of the ill-fated Mary. She took effectual measures for securing the interest and services of those persons on whom it was equally natural, and apparently proper for her unsuspicious cousin to rely, as guides and council in the administration of a precarious and difficult government. This is not the proper place to enumerate the impolitic, if it cannot even be said immoral steps, by which Mary hastened the consummation of her evil fortunes, or to describe the hardships, vicissitudes, indignities, and deprivations, which she experienced, and which at last drew forth as much magnanimity on her part, as they manifested tenderness or humanity on that of her opponents and persecutors. Suffice it to mention, that one calamity followed another, till, to her terrified imagination, there remained no hope but by throwing herself on the power, for it would be mockery to predicate a milder term, of the very individual who had all along studied to accomplish and forward her ruin, though she had latterly professed reconciliation, and affected to interpose on her behalf.

On arriving at Carlisle, Mary wrote a letter to Elizabeth, describing her distressed circumstances, and craving protection. After some deliberation, the queen, whose courtly ministers took care to point out the kind interference of heaven in her behalf, resolved to profit by the event which had thrown so hated a rival into her hands; but, at the same time, to save appearances, and more effectually accomplish all her objects, by some indications of sympathy and friendship, Lord Scrope and Sir Francis Knolles were quickly dispatched with a message of a tender and condoling nature, and also private instructions to watch Mary's motions, and prevent her escape from the kingdom. To a request of a personal interview on the part of Mary, it was replied, that till she had cleared herself of the foul charges with which she had been accused, it would be construed to the dishonour of the queen to shew her public countenance. This galling remark drew tears from Mary, who, however, either from conscious innocence, or a sense of the urgency of her situation, declared, that she would willingly come before the tribunal of her sister on the trial of her guilt. Such a concession was peculiarly desirable to Elizabeth,

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as it established her as umpire between Mary and the opposing regent of Scotland, and afforded a pretext for detaining the former till the issue of the inquiry, which, besides, she might readily contrive to defer as long as circumstances required. The earl of Murray, therefore, bastard brother of Mary, who now held that office in the minority of her son, James VI., was immediately directed by Elizabeth to bring forward his accusations; and commissioners, mutually chosen, were appointed to hear both parties. Mary discovered, when it was too late, the danger of the snare into which she had fallen, and endeavoured to evade the proposed trial, as a voluntary diminution of her dignity. But her reluctance increased the solicitude of the queen, whose insinuating and plausible professions at last prevailed.

Into the particulars discussed in the extraordinary conference now held at York, and afterwards in London, it is unnecessary, because it would be unsatisfactory, to enter. The subject of Mary's concern in the murder of her husband Lord Darnley, the chief and only formidable accusation against her, as is well known, is now rather the touchstone of party spirit and personal prejudice, than susceptible of perfect elucidation. Now, on this rock, there is not the slightest intention of committing a *felo de se* in the eyes of any contending reader. Suffice it to say, that, on the one hand, Mary *did* not publicly enter upon her vindication from that foul aspersion; and that, on the other, Elizabeth refused a private interview, which was repeatedly solicited, in order either to manifest her innocence, or to substitute something in its place. Perhaps all the persons engaged in this perplexing and indecisive conference, if such it may be called, acted insincerely, and with respective sinister designs, rather than a conscientious resolution to accomplish the object for which it was ostensibly held. It was at length broken off, certainly on just grounds, by Elizabeth, who at all events effected her purpose of decoying Mary into secure confinement, though she still pretended to negociate with the captive princess, and to regret the occurrence of any difficulties which seemed to prevent an honourable and satisfactory adjustment. Of the importance which was attached to the subsequent safe custody of Mary, an idea may be formed from a letter in the papers of Sir Ralph Sadler, one of the persons to whose vigilance she had for a time been committed. That knight having been found fault with on one occasion, for suffering Mary to accompany him, amidst a host of guards, on a hawking excursion, is at pains to explain the nature of the indulgence, and diminish its hazards. He concludes his statement in rather a peevish, but nevertheless explicit enough manner: "But syns it is not well taken, I wolde to God some other had this charge, that wolde use it with more discretion than I can; for I assure you, I am so wery of it, that, if it were not more for that I would do nothing that shulde offende her Majestie, than for fear of punishment, I wolde come home, and yelde myself to be a prisoner in the Tower all the days of my lif, rather than I wolde attende any longer here upon this charge!" The place in which she was at this period confined was Tutbury in Staffordshire, whither she had been removed from Bolton in Yorkshire, which was thought less appropriate from its being surrounded with catholics.

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But neither the artifices nor the prisons of Elizabeth could prevent many of her subjects from feeling interest at least in the fortunes of captive royalty. Her harshness was blamed, because, even admitting the guilt of Mary's conduct, no one could demonstrate the right of the queen to extend punishment to it at her own will, or, in reality, to withhold the opportunity of ascertaining the one and fixing the other. But Elizabeth's reasons for detaining her prisoner received strength by the circumstance of Mary's party in Scotland, availing themselves of the murder of the regent, to assemble in some force, and assume a threatening aspect on the borders of the two countries. Their measures were thwarted, indeed, by her superior means and art; but it was obvious that the presence of their sovereign, rendered more an object of regard than ever by the calamities which she had experienced, might impart a very serious agency to their zeal.

Not more fortunate for Mary was another attempt in her behalf, by one whose motives, as they were more selfish, were the more likely to be unintermitting. This was the duke of Norfolk, the first nobleman in England for rank and influence, and whose qualities and behaviour had procured universal esteem, but on whose susceptible feelings, long attached as they had been to the cause of Mary, her charms and accomplishments raised an emotion inconsistent alike with his safety and previous obligations, and which, besides endangering the object of his ardent affections, ultimately conducted him to the block. After the death of this nobleman, whose very sincerity had hastened his fate, by directing his attention to the laudable nature rather than the portentous consequences of his conduct, Mary was more vigilantly watched than before, but seems never to have abandoned the hope of one day accomplishing her liberty. A plot for this purpose, and her consequent establishment on the throne of England, by the murder of Elizabeth, extensively arranged and powerfully supported, was discovered, and its leaders were justly put to death. Mary, who had undoubtedly so far acquiesced in the scheme as to endeavour by means of it to effect her escape, was now brought to trial as a party in its fabrication and atrocity. After objecting to the competency of the tribunal, she consented to plead in her own behalf, but was refused the aid of counsel and the confronting of the chief witnesses, which the meanest individual in the present times is entitled to demand. Her fate was decreed before an argument had been advanced,—for one of Elizabeth's counsellor's recommended the use of poison rather than incur the odium of a trial; and Mary received sentence of death, which was put into execution at Fotheringay castle, in the 45th year of her age, and the 19th of her residence as a prisoner in England. The queen was hypocrite enough to be solicited and urged by her obsequious parliament, to yield to the event which for ever freed her from the dangerous machinations and bewitching influence of her far more amiable rival.

Elizabeth's uneasiness, affected or real, at the execution of Mary, and any apprehensions she entertained of its effects on the king of Scotland, who at first manifested high indignation at the treatment of his mother, or any other foreign power, were lost in her concern for the issue of the contest with Spain in which she was engaged. Philip, the sovereign of that country, long meditated the destruction of England, against which his resentment was more particularly excited by the encouragement given by it to his revolted subjects in the Netherlands. His preparations were proportioned to his hatred, and issued in an armament, the magnitude and power of which justly awakened the fears and required all the precautionary sagacity and exertions of Elizabeth. Under the word ARMADA, is given an account of the extent and fortune of the portentous equipment which was to execute the vengeance of the Spanish king, but the miserable fate of which still serves as a cordial *memento* in the contemplation of any stupendous threatenings. It was at this period that there arose among the English a race of naval heroes, which has been perpetuated with augmenting lustre to the present times, and in whose chivalrous spirit, intrepid valour, and well-disciplined hardihood, their country never ceases to repose its hope of safety and its love of glory. The names of Raleigh, Howard, Drake, Cavendish, and Hawkins, lead the van in an array which has often decided the fortune of Europe, and always compels the attention of the world.

Elated by her success in vanquishing the designs of Philip, the queen became an assailant in return, and with more effect. The capture of Cadiz, by a fleet and army under the command of the earl of Essex, was a serious mortification to the Spaniards, and on various other occasions they suffered considerable losses. The nobleman now mentioned was among the most eminent of those officers by whose achievements the bravery of the English was crowned. His eminent services had gained the applause of Elizabeth, and his personal qualities had made a deep impression on her heart. The death of the earl of Leicester, her former favourite, left a void, which his various merits were calculated very amply to supply, and certain it is that no one had more effectually obtained the mastery of her affections. His promotion kept pace with his own deserts and her good opinion. It had been well for him if he had known the art of preserving, as well as that of procuring favour. His high-mindedness was greater than was befitting a minion; he forgot the respect due to his sovereign, and exposed himself, by want of caution, to the malignity of his enemies. His failure in subduing a rebellion in Ireland from which he expected an accession of glory, gave them an opportunity of injuring him at home. But even his misfortunes, and their artifices, were in a fair way of being overcome, when his impatience, indiscretion, and criminal ambition hurried him into projects inconsistent with the public peace, and which ended in his ruin. He was tried, condemned, and executed, not without sincere regret, and the most painful irresolution on the part of the queen, who never afterwards was known to enjoy one happy day. A circumstance connected with the death of that unfortunate nobleman, deserves to be recorded, as full of interest, and highly characteristic of Elizabeth in several respects. She had in an early period of their intimacy presented Essex with a ring, and enjoined his sending it to her in any critical conjuncture which might require her friendship and influence in his behalf, as the sight of it would revive her affections, and procure his safety. This ring, then, he actually transmitted, after his condemnation, which accounts for the hopes he continued to entertain of receiving pardon. But the Lady Nottingham, prevailed on by her husband, an enemy of the favourite, whom he employed as his messenger, never delivered the pledge. The queen, indignant at his obstinacy, as she thought, never knew the treachery which had been so fatally practised against him, till the countess, apparently struck with remorse in her last illness, revealed the secret. Its effect was fearful. She shook the dying woman in her bed, cried ' that God might pardon her, but she never would," and resigned herself to the horrors of unalterable despair. The violence of her grief, aggravated probably by a variety of uneasy reflections, and the consciousness that some of her courtiers were already negociating favour with the heir-apparent to the crown, besides the infirmities of age, rapidly brought on fatal symptoms. In this state she was interrogated as to her sentiments respecting a successor, when she distinctly and energetically specified the king of Scotland as alone entitled to that honour. After this she fixed her attention on eternal concerns, sank into a lethargy, and expired without a groan, in the 70th year of her age, and the 45th of a reign, which, notwithstanding all her selfishness, arbitrary proceedings, parsimony, and want of true benevolence, it is impossible not to contemplate without sentiments of admiration, respect, and gratitude.

CHAP. II. HISTORY OF SCOTLAND.

THE Scots, like their southern neighbours, have been anxious to carry back their history to a very early period. Their success in the attempt has been still less obvious and insinuating. Very uncertain legends enumerate a series of kings who existed several ages before the Christian era, and detail with some minuteness the occurrences which characterised them. But they are alike improbable and void of interest,—a sufficient reason why no modern author, however patriotic, has had the hardihood to incorporate them with materials which deserve the title and the meed of authenticity. The earliest accounts of this country, claiming respect, are of Roman growth, not indigenous. When the masters of the world extended their conquests, under Agricola, to this part of the island, they found it inhabited by the Caledonians, of whose origin, manners, and fortunes, it is not now intended to speak. The Romans having repulsed rather than subdued this hardy and valorous people, built a strong wall between the friths of Forth and Clyde, as the boundary of their empire. But the difficulty of maintaining so distant a province, induced Adrian to contract it, by erecting another wall considerably to the south. The possession of the intermediate space was in subsequent times contested by these foreigners and their native opponents, till the necessity of defending their

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own vitals, threatened by the Goths and other barbarians, obliged the former to retire to the continent, about the beginning of the fifth century. The Romans amply compensated for the aggressions and occasional severity which they had committed, by communicating some of the elements of civilization, the valuable art of writing, and the use of numbers.

Scots subdue the Picts, A. D. 838.—On their departure, the northern part of Britain was left in the hands of the Scots and Picts,—this last term being used by Bede and other historians as synonymous with Caledonians. The former, who are not mentioned by any Roman writer before the end of the fourth century, were probably a colony of the Celts or Gauls, whom they seem to have resembled in almost every particular of national character. Between these two people, war was carried on for ages, with various success. At last, Kenneth II. called the 69th king of the Scots by fabulous authors, completely vanquished the Picts, and united the whole country, from Adrian's wall to its northern extremity, under one sovereign. From this period the name of the victors, though originally strangers, was applied to the kingdom, and the manners and language of the two people, in all probability never very dissimilar, became inseparably blended. Long before this event, the Christian religion had been introduced into the country, and existed in a purer form than it assumed in the fifth century under the management of Palladius, by whom the Roman Catholic system was established, to the prejudice of the primitive faith. So much for the first of the four periods, into which the judicious Robertson has divided the history of Scotland,—"a region of pure fable and conjecture, (says he) that ought to be totally neglected, or abandoned to the industry and credulity of antiquaries." The second period, according to the same author, reaches from Kenneth's conquest, now mentioned, to the death of Alexander III. In it there is a dawn of light, deserving to be noticed as the commencement of day, and presenting a few objects on which vision may be exercised with some degree of interest. A mere summary of the chief events, therefore, will suffice.

Kings till Gregory, A. D. 883.—Kenneth removed the episcopal see established by the Picts, at Abernethy in Perthshire, to St Andrews. He warred with the Britons. Before and during his reign, the Danes made frequent landings in Scotland. The short reign of his successor, Donald, a feeble and indolent prince, gave advantage to the English, with whom he entered into war. In the following reign of Constantine II. the Danes, under Hobba and Humber, ravaged the country from Fife to the western coast, whence they sailed into Ireland. On their return, they again defeated the Scots under Constantine, who was slain. Grig or Gregory, the next sovereign but one, expelled the Danes, made several successful inroads into England, and one into Ireland, whose king, Duncan, he is said to have made prisoner. The surname of Great has been given to Gregory, which he is thought to have merited by his magnanimity, and, comparatively speaking, splendid deeds.

Kings till Malcolm II. A. D. 1001.—Donald II. or, reckoning the fabulous kings, the sixth, the son of Constantine, had various conflicts with the Danes, who appear about this time to have settled in Moray. He died at Forres of wounds received in battle. His successor, Constantine, nephew of the second prince of that name, formed a very impolitic alliance with the Danes against the English. He was completely defeated by Athelstan, in a battle at Brunanburgh, supposed to be the same as Brugh, and with difficulty escaped. This loss affected him so much, that he retired to a monastery at St Andrews, where he ended his days. Malcolm I. son of Donald, a sagacious and prudent prince, formed an alliance with Edmund of England, from whom he received the principality of Cambria or Cumberland, on doing homage. He lost his life in an expedition to reduce the people of Moray to obedience. Indulph, son of Constantine, who succeeded, repelled a new body of Danes who landed on the shores of Buchan, but perished in the battle. Duff, son of Malcolm, and prince of Cambria, the next king, had a short reign, noticeable for his zeal to reform abuses, which ended in his own ruin. Colin, or Culenus, his successor, was slain in battle against the Britons of Cumberland, who were again vigorously opposed, and their royal family extirpated by the next king, Kenneth, son of Malcolm. This able prince had a severe conflict with the Danes who landed in Argyleshire from Man and some of the neighbouring isles. It was in a battle with that people, in which the Scots were at first thrown into confusion, that a countryman of the name of Hay signalized himself in preventing their flying from the field,—a service for which he was ennobled and had an estate conferred on him. To Kenneth, slain by a traitor, succeeded Constantine, son of Colin,—for, at this period, it will have been observed, each king appears to have been pretty regularly succeeded, not by his own son, but his predecessor's. Now, however, there arose a rival in the person of Malcolm, son of Kenneth, and the country was torn by factions. The former was slain during their contest, in a desperate battle fought on the banks of the Almond water. Grim, son of Duff, was now crowned king, but met with opposition from the same individual, who ultimately accomplished his ambition by ascending the throne. He proved a brave and able prince, but appears to have been too liberal to his retainers in early life, and, as is not unusual, to have become avaricious in his old age. He was successful against the Danes, who had anew invaded Moray and Buchan, where they were almost certain of being favourably received by the descendants of their countrymen.

Malcolm III. A. D. 1057.—Duncan, grandson of Malcolm, succeeded to the throne. He was a mild and gentle prince, and deserved a better fate than he experienced. An insurrection of some of his subjects, aided by a body of Irish, was overcome by the bravery of Macbeth, to whom he gave the command of his army. Then the Danes landed in Fife in great force. After a severe battle with them near Culross, a treaty was proposed, during the adjustment of which, some victuals, impregnated with the juice of the deadly night-shade, were conveyed into the Danish camp. Its effects enabled the Scots to attack them in such a manner that their leader and a few persons were all that escaped. Macbeth, aiming at the crown, did not scruple to murder his sovereign, in order to attain it. The power thus wickedly acquired was used with some judgment, but no less severity. In the end he excited the dislike of the nobility, many of whom fled to Malcolm Canmore, the son of Duncan, then residing in Cumberland. Encouraged by their allegiance, and the assistance of Siward, earl of Northumberland, this prince ventured to attack the usurper, and with complete success. He ascended the throne of his ancestors, in spite of the efforts of Lulac, son of Macbeth.

The history of Scotland becomes somewhat more satisfactory in the reign of this prince. His dominions extended over the whole of what is now called Scotland, in addition to the province of Cumberland, which he continued to hold in feudal tenure. Having espoused the cause of Edgar Etheling, heir of the Saxon race of kings, whose sister Margaret he had married, he provoked a war with William the Conqueror, which was prolonged with various fortune, even after Edgar himself thought proper to acquiesce in the usurpation of that prince. The court of Malcolm formed a place of refuge for the disaffected English; and from them, in all probability, was derived a degree of refinement which compensated for the otherwise prejudicial effects of the embittered contest. William Rufus, after establishing himself in the throne of his fathers, prepared to dispossess Malcolm of the places which he had acquired in Northumberland. But the two monarchs agreed to a peace, which was of short continuance. Malcolm, in order to prevent hostilities, to which his age and devotion disinclined him, paid a visit to the court of his opponent, but being required to do homage, which he conceived inconsistent with his dignity, hastily retired, and commenced aggressions in Northumberland, where he lost his life in an engagement with Mowbray, earl of that county. His son, Edward, fell at the same time. The reign of Malcolm seems to constitute an era in the annals of his country; and his character and fortunes deserve the investigation of some erudite historian.

Kings till David I. A. D. 1124.—The Scots were left in extreme disorder on the death of Malcolm, as his remaining sons were too young to assume the reins of government, and much dissatisfaction had shewn itself among the ancient nobles at the encouragement given to strangers, and the introduction of foreign manners and customs. The crisis was favourable for some daring individual. Donald Bane, brother of Malcolm, usurped the throne, but held it only a few months, the nobles raising up Duncan, natural son of that monarch against him, who soon incurring the hatred of his subjects, was put to death, when Donald again obtained the throne, which he was obliged finally to abandon in favour of Edgar, fourth son of Malcolm, whom the nobles invited from England, where he resided under the protection of his uncle. This prince, who possessed several excellent qualities, maintained peace with the English, to whose good services he had been much indebted, and to whose sovereign, Henry, brother and successor of William Rufus, he gave his sister Matildis, or Maud, in marriage. Edgar was followed by his two brothers in succession. The first of these, Alexander I. is commended for bravery and spirit, whence he got the name of *sharp*, or *the fierce*. He is noted also for his love of justice. He preserved peace with England, and was a benefactor to the church. David I. the other brother, in a shorter reign, accomplished more, and acquired a higher reputation than his predecessor. Even the historian Buchanan, not remarkable for his love of kings, extols him as an honour to his country and to monarchy. His chief political error was excessive love of monasteries, which he multiplied and endowed beyond adequate reasons, and to the prejudice of the best interests of his country. He annexed Northumberland to his crown, but not without a long and severe contest with Stephen, whom he opposed in behalf of his niece, Matilda, the legitimate heir of Henry, as elsewhere related. On the temporary elevation of that princess, David paid her a visit in London; and throughout, his fidelity to her cause and that of her son, Henry, deserves the noblest encomium. The death of his eldest son, also named Henry, was a severe affliction, which it required all his piety to enable him to bear at his advanced period of life. His last measures were judiciously directed to promote the peaceable succession of his grandson, and the comfortable establishment of the other members of his family.

Kings till Alexander III. A. D. 1249.—Malcolm IV. was a minor when he ascended the throne of his grandfather. His reign was troubled by a famine, various insurrections, and a quarrel with the English. By this last he was obliged to surrender Northumberland and Cumberland. He afterwards attended Henry II. into France, as a vassal of that king, which gave great offence to his subjects, some of whom conspired against his life. But he escaped their stratagems, and seemed to be regaining favour by his address and spirit, when he was cut off in the flower of his age. His brother, William, succeeded him, a brave and high-minded prince, who, resolving on the recovery of the English property, was unawares taken prisoner at Alnwick, and thence carried to Henry, at that time in France. He was obliged to do homage to that monarch for his whole kingdom. The Scots, in love to their captive prince, who was a great favourite, consented to the humiliating conditions of his ransom. Richard, the successor of Henry, had the generosity to discharge the obligation, by sending back the noblemen who had been delivered as pledges, and restoring Northumberland to the Scots. This produced a sincere friendship between the two kings, and a peace between their countries, which lasted during the reign of Richard. It was broken for a short time under the vicious government of John, but was renewed on the condition of William's two daughters being given in marriage to the two sons of that sovereign. The remainder of William's time was passed in a state of tranquillity, only a little disturbed by domestic misfortunes, and contributed greatly to the improvement of his subjects in the arts of social life. He died at Stirling, in the 72d year of his age, and the

Civil history. 49th of his reign. Alexander II. succeeded his father when only seventeen years old. He proved an able and valiant prince. The English barons engaged him in their cause against the profligate John, who, however, was for some time successful in ravaging the southern parts of Scotland, which Alexander took good care to retaliate with due animosity. John, by his submission, obtained the protection of the pope, who excommunicated his enemies, and, among the rest, the Scots. A deputation to Rome procured the cessation of this spiritual thunder. The quarrel was renewed with Henry, son and successor of John, but was soon terminated, and peace continued between the countries during the lifetime of these two kings. Alexander repeatedly visited Henry, whose sister he had married, and was always well received. But some jealousies arose on the death of Joan, the Scots queen, and Alexander's subsequent marriage to a foreign lady, which occasioned preparations for war,. though timely mediation prevented bloodshed. Alexander was succeeded by his son, the third of the name, a boy in the ninth year of his age. During the minority of this prince, the family of the Cumins obtained great sway in the government, but were afterwards removed. In this reign the Danes, or Norwegians, landed in great force at Ayr, but were ultimately defeated with dreadful slaughter. Alexander married Margaret, eldest daughter of Henry III. with whom he maintained a good understanding, which was serviceable to both nations. That princess bore him children, whom, as well as herself, he survived. In hopes of a second issue, he married again, but shortly after his union, in going from Burntisland to Kinghorn, was thrown from his horse, and killed in the fall, to the great grief of his subjects, whom he had governed with justice, moderation, and prudence, and who had afterwards to taste the bitter fruits of a contested succession and a civil war. The death of this excellent prince, which took place in 1285, terminates the second period of Dr Robertson's division of Scots history.

The third period of the same author extends to the death of James V. in 1542, containing, therefore, upwards of two centuries and a half, of which he has given a very satisfactory review in his first book, as preliminary to his more copious history of the last period, which again comprehends the time from the date now mentioned, to the accession of James VI. to the crown of England. As that work is universally read, all that is required here is a sketch of the more important events, in the order of time, to preserve continuity and uniformity of design.

Contested succession.—The proper heir of Alexander's crown was Margaret, whom his daughter of the same name bore to the king of Norway. But, at the time of his death, she was an infant and in a foreign country, which occasioned a convention of the estates appointing a regency. On her death, which took place soon after her grandfather's, the right of succession belonged to the descendants of David earl of Huntingdon, third son of king David I. Of these, in particular, were John Baliol grandson of the earl's eldest daughter, and Robert Bruce son of his second daughter. The plea of the former was preferable according to the rules of succession now established; but in those times the order of inheritance was not equally well ascertained, and the prejudices of the people, if not the law of the kingdom, favoured the claim of Bruce. To avoid the miseries of a civil war, the Scots nobility or states hazarded the independence of their country by an appeal to the king of England. Edward profited by the circumstance and the existing anarchy, to state his own pretensions, which, though remote and inconsequential, had the benefit of superior power. He constrained the competitors to acknowledge the sovereignty of the English crown, and having violently taken possession of the kingdom, decided in favour of Baliol, who again professed vassalage, and submitted to every condition imposed on him. But this fealty was of no long duration. Edward's harsh and despotic rule roused the angry feelings and proud spirit of the Scots, and even Baliol himself joined in the rebellion. He was at last obliged to resign the crown, which Edward endeavoured to seize as fallen to the superior lord, when the heroic Wallace animated the resistance of his countrymen. After him arose the grandson of Bruce to vindicate the freedom of Scotland and establish his own right to its throne. His persevering efforts were ultimately prosperous, and the second Edward had hastily to abandon the conquests which his father had won, with vast expense of blood and a tarnished glory. Some of the particulars are worthy of being mentioned.

Robert Bruce, A. D. 1306.—His first measures of resistance to the lordly sway of Edward were so unhappy, that he had much difficulty to escape with a few followers to the wilds of Athole, where he subsisted in an obscure and precarious manner for some time, and had occasionally to encounter the opposition of his own countrymen. He was afterwards kindly treated by earl Malcolm, and Angus Macdonald, lord of the Isles. His expectations of assistance from Ireland were cruelly disappointed by the capture of two of his brothers, and the rout of a small body of men who adhered to his fortunes. But these and other calamities taught him prudence and moderation, not unmanly despair. He collected a small army with which he obtained a victory over the earl of Pembroke at Lowdon-hill. Edward I. who lay sick at Carlisle, heard of the disasters of his troops, and with his last breath enjoined his son to carry on the war with the rebellious Scots. But that feeble prince was tardy in taking his advice, and unfortunate in putting it into execution. The battle of Bannockburn secured the independence of Scotland, and established Bruce on its throne. Such indeed was the esteem in which he was held, after that event, that the assembly of estates, in their sitting at Ayr, confirmed the kingdom in his family. Nor was his fame confined to his own country. The Irish, disliking the government of the English, made him an offer of their kingdom. This he refused in behalf of his brother Edward, who was slain in an attempt to take possession of the honour. During the short absence of Robert in carrying over supplies to that unfortunate prince, king Edward made an attack on Scotland, but was repulsed. This he repeated on Bruce's return, but with no better success. Bruce afterwards avenged the ravages the English commit-

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ted, by an invasion of their country, during which Edward more than once nearly fell into his hands. Peace was finally concluded between the two nations in the reign of Edward III. on condition of the English renouncing all claim to the crown of Scotland, after a contest of seventy years continuance. Robert, whose health had suffered from his severe hardships and fatigues, did not long survive the event. He died at Cardross, whither he had retired from the cares of government, after a reign nominal and real of 24 years. It is worthy of notice among the political measures of this enterprising and able prince, that, on the establishment of his throne, he endeavoured to depress the power of the nobles, which was greater in Scotland than in any other country of Europe. But the attempt had likely to have proved fatal. On his demanding, upon a certain occasion, by what title they held their estates, these haughty chiefs replied by laying their hands on their swords,—a very expressive intimation, at the same time, of their resolution to defend them. Robert Bruce was succeeded by his son,

David II. A. D. 1330,—a minor. The estates appointed Randolph earl of Murray regent, who ratified the peace with England, and applied himself successfully, during the short period in which he held the office, to the preservation of the public weal. In the subsequent regency of the earl of Marr, Edward Baliol son of John, assisted by Edward III. and supported by several factious nobles at home, invaded the kingdom, and with such effect, that he got himself crowned, while David for security was conveyed to France Baliol disgusted the people by his submission to the crafty Edward, and was forced to flee to the protection of that monarch. David was restored after an absence of nine years, but was made prisoner in the battle of Durham during an invasion of England, by which, contrary to sound policy, he endeavoured to aid the king of France, at that time unable to withstand the victorious Edward. He was conveyed to London, and continued captive for eleven years, when he was liberated by ransom, and a truce was concluded for ten years between the two countries. The chief part of the remainder of David's reign was spent in almost fruitless efforts to reconcile his factious subjects, and to introduce among them the virtues and comforts of social life. To him succeeded his nephew,

Robert II. A D. 1370,—high steward of the kingdom, in virtue of a settlement made with consent of the estates, but in opposition to some of the Douglases, a family which at this period had risen to the greatest consequence in the nation. In the commencement of this reign, the truce was broken by the English, and various hostilities were the result, which proved of little moment to either country. Richard II. prepared a large force for the subjugation of Scotland, but his plan was judiciously frustrated by a counter-invasion which rendered it necessary for that monarch to retreat. The two armies returned home after various ravages on their respective enemies, but without having once faced each other in the field. The combats and predatory excursions of the borderers, in this and subsequent times, are fitter subjects for romance than the employment of the historian. They do indeed characterize the times, but had little or no effect on national concerns. To Robert II. succeeded his son John, but whose name by a decree of the estates was changed to

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Robert III. A. D. 1390.—It had been more judicious to change the person than the name; for this being an indolent and weak prince, the management of public affairs was committed to his brother Robert, duke of Albany. That unprincipled man formed a plan for usurping the throne, by the murder of his brother's sons. One of these, who had been committed to his charge, was starved to death at the castle of Falkland; the other, afterwards James I. in order to avoid the same noxious influence, was embarked for France, but driven on the coast of England, and carried prisoner to London. The tidings of this event so affected his father that he abstained from food, and died in three days. The government now devolved on the king's brother, whose bravery and prudence were only surpassed by his ambition. In his regency, the Scots gave assistance to France, by sending over an army of seven thousand men, under the earl of Buchan. It was to render their services ineffective, that Henry carried with him the captive James, their nominal king, whom he forced also to remit orders to their leader. But to such commands the Earl gave no heed, smartly remarking, that a sovereign in the hands of his enemies was possessed of no authority. On the death of the regent, his son Murdo was appointed governor of Scotland. He had not the talents of his father, and perceiving that his own children were refractory, at last saw the necessity of calling in a higher power. At his persuasion, therefore, an assembly of the states agreed to demand their prince from the English king. Henry yielded on promise of a ransom; and thus, after a captivity of eighteen years,

James I. A. D. 1423,—ascended the throne of his father. The seizure and detention of this prince were alike ungenerous and unjust. But in the issue, he had no cause to lament them. They preserved him, in all probability, from the evil machinations of his relatives; and from the latter he derived the advantages of an education and a refinement, for which, even if he had possessed the desire, he must have looked in vain throughout his own country, and which in reality shed the highest lustre on his reign. After firmly establishing himself in the throne, he commenced a series of measures, which had for their object the rectification of a great variety of abuses which had crept in through the distractions of the times and the encroachments of the nobility, and the promotion of commerce, learning, justice, and religion throughout his dominions. If Robert I. vindicated the independence of Scotland, it was James I. who redeemed it from ignorance and barbarity, and gave it rank in the list of civilized nations. But this salutary and praise-worthy task could not be performed without offence in some quarter or other. The nobles and clergy in general were most aggrieved by his reforming principles; and some of the former especially, witnessed the comparative diminution of their exhorbitant and impolitic sway with a jealous eye. A conspiracy was at last formed against him, headed by his own uncle, the earl of Athole, which terminated his life by assassination, in the 44th year of his age. His son,

James II. A. D. 1437,—was a minor at his accession, which occasioned the appointment of Sir Alexander Livingston and Sir William Crichton to the management of public affairs, and the custody of the king's person. The altercations of these men, in which their respective friends took part, were most injurious to their country, and the more so as their mutual jealousies and divided counsels enabled the earl of Douglas to establish himself in a sort of independent sovereignty, which for a time claimed almost all the honours, as it seemed to possess all the power of the crown. This was apparently a crisis favourable to the English, who accordingly invaded the country under the earl of Northumberland, but were defeated in Annandale with great loss. After this victory, the king married a daughter of the duke of Guelderland, and proceeded to extremities with Douglas, whom he stabbed with his own hand. The friends of that nobleman were afterwards, on refusing to attend a summons of the states, declared enemies to the commonwealth, and fled to England, where they obtained some aid, with which they invaded the kingdom, but were ultimately repelled. James copied his father in instituting laws, and promoting the civilization of his subjects. He would probably even have surpassed him, if the bursting or accidental discharge of a cannon, at the siege of Roxburgh castle, which he was endeavouring to recover from the English, had not terminated his life too soon for the developement of his plans. This took place in the 30th year of his age. On this distressing and unfortunate occurrence, the queen displayed remarkable energy of mind. She had just arrived in the Scots camp, and learning the disaster, exhorted the soldiers to prosecute the siege, saying she would bring them another king. This was her son, at that time only seven years old, whom the army with triumphant shouts saluted as their sovereign.

James III. A. D. 1460.—During the minority of this prince, eight persons were appointed to administer the affairs of the kingdom; but Lord Boyd, by seizing the person of James, and gaining an ascendency over him, monopolized the authority. This did not long continue, and the devices of that nobleman issued in his own ruin. The king married a daughter of the Danish monarch. He affected, with very inferior talents, to copy the example of his father and grandfather. But he disgusted his nobles by his favour to mean persons, and want of dignity. A conspiracy among them, in which his own brothers took a part, had the aid of Edward IV. but proved ineffective from the death of that monarch. Another actually forced the king's eldest son to declare against him, and led to an engagement which ended his ignoble reign in the 35th year of his age.

James IV. A. D. 1488.—This accomplished and amiable prince adopted a line of conduct which seemed to attain two almost irreconcileable objects, the prosperity of the people, and the affections of the nobility. His marriage too, with Margaret, daughter of Henry VII. promised a lasting tranquillity between the rival nations. It had been well for Scotland if this prospect had not received interruption in the reign of Henry VIII. by the high spirit and vindictive feelings of their respective monarchs, which led to one of the cruellest catastrophes it had ever experienced. James having conducted an army into England, took several places by storm, when his advisers recommended him to retreat, so as to avoid the English under the earl of Surrey, who had been collecting numerous forces, while his own, from various causes, had been considerably reduced. The king, indignant at the proposal, rashly hazarded a general engagement, in which his principal nobility fell, and he himself lost his life. This was the fatal battle of Flouden or Flodden, which, by cutting off the head and chief members of the state, again involved the kingdom in all the natural and adventitious disadvantages of a minority.

James V. A. D. 1513,—was only two years old when he succeeded his father. The queen, his mother, appointed regent, soon lost her authority by marrying the earl of Angus. To her succeeded the king's uncle, John, duke of Albany, a native of France, attached to the interests of that kingdom, and totally unable by his own talents, aided even as he was by foreign power, to controul the aristocracy, which again acquired a dangerous and paramount influence. His chief opponent, in the early part of his administration, was the earl of Hume; and latterly he had to struggle with the intrigues of the queen dowager, sister of Henry VIII. Irritated at last, and disgusted at the difficulties and miseries to which his office exposed him, he retired to his native country. On his retreat, the earl of Angus became master of the king's person, and ruled in his name, in spite of many efforts to deprive him of authority. In him was restored, therefore, the supremacy of the Douglases, which had been before so pernicious to the kingdom. The prince was in reality a prisoner for some time in the hands of that nobleman, who had the audacity to tell him on a certain occasion, that rather than allow him to be taken by the enemies of his family, he would lay hold of his body, and, should it be torn in pieces, would be sure at least of keeping part of it. But James at last escaped, and calling a parliament, deprived the Douglases of their places, and declared them enemies of the state.

About this period, the protestant religion began to dawn in Scotland, but, as usual, experienced opposition from those who were interested to prolong the ancient faith. Patrick Hamilton, a young man of a noble family, who had espoused the reformation when abroad, may be considered its first martyr in his native land. James married first a daughter of the king of France, and, on her early death, secondly, Mary of the house of Guise, at that time of the greatest influence in the same kingdom. He was prevented by his ecclesiastical retainers from holding an interview with Henry VIII. whom they naturally disliked. A war afterwards took place with that monarch, and James found it necessary to court the aid of those noblemen whom it had previously been his endeavour to reduce from their baneful eminence. But they meditated revenge, to the prejudice of national honour, and absolutely refused to cross the frontier, when an opportunity offered of cutting off the English army. Nor did this suffice for the mortification of the king. In a subsequent engagement, his army, amounting to 10,000 men, taking offence at his appointing one Sinclair, a private gentleman, to be their general in room of Lord Maxwell, surrendered to a body of English horse not more than a twentieth part of their number. This disgrace so afflicted the high-spirited James, that he abandoned himself to despair, and died of a broken heart in the flower of his age. On hearing, a little before his death, that his queen had brought him a daughter, his only surviving child, he exclaimed, "The crown came with a woman, and it will go with one; many miseries await this poor kingdom. Henry will make it his own, either by force of arms, or by marriage." These words were partly prophetic. But the rival whom he named did not live long enough to witness the calamities which he predicted. The princess whose birth drew forth this prophecy from her dying parent, was Mary, the inheritor of some of his talents and all his spirit, but who far surpassed him in the experience of misfortune.

Mary, A. D. 1542.—The government of a queen was a novelty which the Scots were far from being agreed to esteem; and that of a queen who was an infant, was still less likely to command their respect. There was yet another reason for uneasy feeling, and the absence of confidence in the present instance, in the omission, on the part of her father, to appoint proper persons as the guardians of her safety, and the directors of her education; even the office of regent he had not filled up; the factions among the nobility, besides, portended disquiet; and to all the other grounds for apprehension, was added a very unsettled state of the public mind on the highly important subject of religious faith. Altogether, then, one can hardly conceive a more unpromising condition than what was now presented in this kingdom.

The first measure of the actual government was, the unprincipled production of a forged testament, by which cardinal Beaton, who had performed the part of prime minister, laid claim to the dignity of regent, which he immediately assumed. This was disagreeable to a large portion of the community, who detested his character, dreaded his bigotted attachment to the ancient religion, and were indignant that the nation should be submitted to the sway of an insolent and illiterate ecclesiastic. Some of the nobles especially testified their dislike, and urged James Hamilton, earl of Arran, and nearest heir to the queen, to accept that high station, in which they were countenanced by the popular voice. This was a well-meaning, but an irresolute and feeble man, very unable of himself to cope with his bustling and crafty rival. He was favourable to the reformation, which now shed a ray of truth and rational freedom across the land,—a circumstance of no small efficacy in obtaining partizans; but, on the other hand, his too evident bias to the political views of the English monarch, who at this time projected an alliance between his son, Edward, and the infant queen, lost him much of the public confidence, and occasioned events very fatal to himself and the kingdom. Beaton, availing himself of this imprudence, and some ungenerous acts of Henry, who appears to have contemplated the entire subjection of Scotland to his dominion, artfully recovered influence with the patriotic nobility, and, by seizing the persons of the young queen and her mother, augmented his power by the authority of the royal name. Arran had not strength of mind to do justice to his own views, but varied with the current of the times. In the month of August he entered into a treaty with the English king, and proclaimed the cardinal an enemy to his country. In the following month he abandoned that alliance, and united himself with the opposite interest. Nor was it long before his religious sentiments became as much altered as his political conduct, when he gave his sanction to the persecution of the protestants. This wavering disposition and fickle behaviour had their usual effects, in rendering him odious to his former friends, and of little or no consequence among his new associates. The cardinal, on the contrary, had attained the height of his ambition, and entertained dread of no one but the earl of Lennox, whose hereditary enmity, and considerable influence, he had previously employed in his own behalf against the regent, but whose disappointed expectations now vented themselves in a change no less remarkable than what that infatuated nobleman had displayed. The contest between these new enemies was decided by the superior artifices of Beaton. Lennox, espousing the cause of Henry, who now sought, by a short but destructive invasion, to resent the indignity he had experienced from the Scots, was at last obliged to seek his safety in the court of that monarch, where he was well received, and where he obtained the hand of Lady Margaret Douglas, Henry's own niece, from whom sprung that race which afterwards filled the throne of both kingdoms.

Henry, blasted in his projects, endeavoured to exclude the Scots from a treaty of peace which he found it necessary to make with France, thinking afterwards to inflict on them more ample punishment. But the generous Francis I. rather than give up his allies, consented to sacrifices which purchased their comprehension. This event, become very requisite to the nation, was made still more agreeable to the majority of the people by their previously getting rid of the cardinal, whose haughty behaviour in general had excited almost universal hatred, and whose severe treatment of the reformers, together with some personal injustice, at last excited the zeal and vindictive feelings of some individuals, which were gratified by his assassination in the castle of St Andrews. This certainly unjustifiable deed delivered the country from an offensive and pernicious man, and in reality was a deathblow to the catholic religion and the French interest in the kingdom. Arran, secretly rejoiced at the fall of one who had eclipsed his authority, for decency's sake affected resentment against the conspirators. These, if not at first instigated, were at all events subsequently supported by the English king, from whom, too, they appear to have expected such military aid as would accomplish a much more important object than indemnity for their offence. But the death of

Henry frustrated their hopes. The ministry of his successor, Edward, resolved to attain the same end by different means; and accordingly the protector, Somerset, entered Scotland with a force intended to compel the acceptance of the treaty which had been so long and anxiously held out as eligible for both countries. Had the prudence of the Scots equalled their number, they must have cut off that able general in his perilous state at Pinkey. But his victory in the fatal battle at that place, however immediately decisive, had little or no effect in forwarding his design, as he himself was under the necessity of returning home in order to guard against the cabals by which he was threatened; and the Scots, on the other hand, so far from yielding to his terms, or submitting to his power, became more resolute in their engagements with France. Indeed, it was from that country alone they could hope for adequate assistance in their present enfeebled and dispirited condition. The queen-dowager, attached by birth, relationship, and affection to the French interest, and who had, on the death of the cardinal, assumed some direction in public affairs, naturally and very sagaciously promoted an alliance which was so flattering to her own inclinations and vanity.

The nobility of Scotland at this period exhibited little of that love of independence, and the unconquerable mind, which had so often borne up their ancestors in equally alarming disasters, and seem to have been panic-struck into a total dereliction of their previous political sentiments. Anxious to wreak their revenge on the English by any means, rather than considerate of the welfare of their country, they hastily fell in with the queen's proposal to offer their sovereign in marriage to the dauphin, and actually to send her to the French court for her education till the period when the alliance could be consummated, as an inducement to favour them with the support which their critical situation required. Henry II. readily acquiesced in a plan which promised ultimate remuneration for any expenditure. Even the immediate effects of the operations which his troops carried on in Scotland served as a diversion, and enabled him to wrest Boulogne from the English.

There were not wanting some patriots who had the sagacity to disapprove, and the courage to censure the policy which reduced the kingdom to the rank of a province, and which accepted for an ally a power that was likely to prove more prejudicial than the ancient enemy whom it was thus intended to provoke and chastise. But events happened differently from what any one might have expected. On getting possession of the young queen, who was carried abroad in the sixth year of her age, the French allowed the war to languish in Scotland; and a revolution in the affairs of the protector, which brought the earl of Warwick into power in England, presented a fair opening for Henry to negociate a general peace. This was accomplished on terms very favourable to France, which alone reaped advantage by the quarrel of the two nations. The Scots, sensible of their error, took umbrage at their allies, whose manners and character they could not relish, and whose insolence became at last intolerable. An aversion to that people now commenced, which had no inconsiderable bearing on subsequent events.

Hitherto Mary of Guise had only covertly interfered in the councils of the nation; but to her aspiring mind it now appeared practicable to attain a legal right to the highest authority. The means which she employed to realize her prospects shewed uncommon penetration, and did justice to her ambition. Various almost insurmountable difficulties were overcome by her artifices, parties most opposed were reconciled to her pretensions, and the regent himself, either intimidated by the growing symptoms of a general defection, or won by arguments more congenial to his feelings, actually resigned his office in her favour.

The first measures of the queen-regent were not of a piece with her usual prudence and moderation. The appointment of foreigners to important stations naturally gave offence; and her visible partiality to French interests, threatened the sacrifice of the welfare and honour of the country whose affairs she was called upon to administrate. It was not long before the dissatisfaction became as public as it was extensive. The nobles, especially, who were in reality what they have been denominated, the leaders of the people, expressed their resentment in a manner not to be misunderstood, and highly galling to her vanity. But she still maintained sufficient influence, and exercised sufficient artifice, to get the marriage-treaty between the young queen and the dauphin accomplished in a way very advantageous to the French, though not without opposition, particularly from the house of Hamilton, whose pretensions to the crown were in material danger of being set aside by the arrangement.

Hitherto the queen-regent, from refinement of policy much rather than regard to their principles, had shewn a conciliatory and indulgent spirit towards the reformers, who for some time past were gradually gaining ground in the kingdom, and who, in return, were by no means remiss in promoting several of her designs. It is singular, on the other hand, that the catholics, whose sentiments were decidedly her own, had not seldom endeavoured to thwart them, and, in the case of the treaty, exhibited a degree of opposition amounting to obstinacy and violence. Neither party, it would appear, understood its genuine interests, or adopted the line of conduct which seemed likely to realize them. So much the more reason, therefore, is there for admiring that providential interference, which, in course of time, and occasionally by adverse agents, brought about an entire revolution in the religion of the country. If, disregarding the operations of a higher power, the inquiry into the causes which produced that event be confined to merely human agents, a degree of sagacity and foresight must be allowed to the promoters of it, which have very rarely indeed been displayed among mankind.

The severities with which they were treated in England, under Mary, induced many of the protestants to take refuge in the sister kingdom, where political motives secured at least protection for their lives, and some degree of liberty for their consciences. Even the archbishop of St Andrews, who geverned the church in Scotland, manifested a moderation and good temper which allowed the new doctrines a fair appeal to the judgment of the people. But the conduct of this prelate being by no means founded on principles of enlightened policy or attachment to the doctrines of the reformation, underwent material change, after the resignation of his natural brother, the late regent, devolved the power of the government into the hands of the queen-mother. Either with a view to thwart her alliance with the protestants, or because he was instigated by the clergy, he began to persecute them with such rage, that they were obliged to apply to her for relief. The queen-regent afforded them protection, but prevailed on them, at the same time, to relinquish their judicious intention of soliciting redress in parliament. This conduct implied an insincerity which ought to have led them to distrust her professions. But her subsequent proceedings left them in no doubt as to the sinister motives which had hitherto prompted her apparent attachment. On the accession of Elizabeth to the throne of England, she lent herself entirely to the designs of her family with respect to that kingdom; and in order to forward them, it became necessary to court the favour of the popish party which had previously sided against her. One effectual mode of doing so, of course, was the very reverse of her former indulgence. But its consequences were quite different from what she anticipated.

On their perfect conviction of the queen's altered intentions to their disadvantage, the protestants ventured, by some of their friends, to expostulate with her concerning a treatment which they had so little merited. Her answer deserves the praise of being at least candid. She gave them to understand that she had really resolved on extirpating the reformed religion out of the kingdom. This extraordinary declaration drew forth a remark which rather bluntly compared her present determination with her former engagements. The queen, irritated at their uncourtly address, lost her usual moderation, and said, "the promises of princes ought not to be too carefully remembered, nor the performance of them exacted, unless it suits their own conveniency." But this harshness was greatly exasperated, on her learning that the protestant religion had been publicly exercised in Perth. She now relinquished all disguise, and proceeding on her avowed determination, summoned all the teachers of that faith to a court of justice at Stirling. The protestants, now united under the name of the Congregation, resolved on protecting, to the uttermost, those persons to whom they looked up as their guides in the most important of all concerns, and agreeably to an ancient practice which permitted persons accused of any crime to be attended to the place of trial by their friends, assembled from all parts of the kingdom to witness the proceedings. Their number was so formidable, unarmed as they were, that the queen thought it safest to dismiss them with a promise that the trial should not go on. A communication to this effect was held so trust-worthy, that the multitude retired to their respective habitations, leaving the preachers with a few leaders at Perth. But no sooner was this perceived, than the queen, utterly violating her word, proceeded to arraign them in ordinary course, and on their non-appearance declared them outlaws. Such a display of falsehood and deceit produced its natural impression. The protestants saw that matters were come to an extremity, and that nothing remained for their safety but the vigorous use of weapons, which some time before they would have regarded as quite irreconcileable with their cause. It was about this period that John Knox returned to his native country, with all the zeal which opposition so naturally excites in an ardent and conscientious mind. His manly but coarse rhetoric had the double effect of exasperating preconceived animosity, and invigorating friendly conviction. The powerful impression made by one of his public discourses at Perth, in which he inveighed against the abominations of the established religion, was most imprudently seconded and enforced on the part of a priest, by preparations for celebrating mass. The effect of the images and relics was electrical on the already inflamed multitude, who speedily manifested the reality and strength of their present belief by the demolition of every object which had formerly claimed their veneration.

Such obnoxious violence, in all probability never contemplated by the reformers, who had hitherto adopted a more rational procedure, filled the queen with rage and hatred. She immediately marched with such troops as she could muster towards Perth, intending to surprise the delinquents. But they, anticipating the result of what had occurred, were prepared for resistance, and soon found themselves able to take the field against her forces. Neither party, however, thought it convenient to hazard a battle; and, accordingly, a treaty was concluded, which offered indemnity for the past, and promised the interference of parliament to compose the existing differences. But the protestants, already deceived by her, and perceiving clearly that these concessions were extorted by her difficulties, bound themselves anew to re-assemble in the event of any violation of faith on her part. Nor was this an unnecessary precaution. The introduction of French troops into Perth, and other measures, demonstrated her perfidious purpose; and the protestants again had recourse to arms in self-defence, and that too with the concurrence of persons who had formerly stood aloof, or were even associated with the queen, but whom her breach of promise and duplicity had altogether disgusted.

Outstripped by their activity, and alarmed at their number and aspect, that ill-judging and faithless woman once more attempted the accomplishment of her designs by negociation. The leaders of tho Congregation, much reason as they had to confide in their strength, and animated now by an additional and powerful principle, the love of civil liberty, which they saw endangered by the employment of foreign troops, and the other measures of the administration, nevertheless had the moderation to consent to a cessation of hostilities, on conditions which not only implied their former demands but also the expulsion of the French from the kingdom. Here, too, her insincerity was manifested, on which the protestants laid

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siege to Perth, and, without listening to fresh overtures on her part, soon forced its garrison to surrender. After this they frustrated her intention to seize Stirling, and advanced with rapidity to Edinburgh, which she abandoned on their approach, and where the inhabitants in general hailed them as their friends. They now resolved on fixing their residence in the capital, and establishing the Protestant religion on the ruins of Popery. Knox, and some of his brethren, were accordingly appointed to the vacant pulpits, in which they laboured with equal ardour and success.

In the meanwhile, the Queen lay at Dunbar, waiting when their indiscretion, or a relaxation in their vigilance and exertions, should give her an opportunity of attacking them with effect. This soon presented itself; and she advanced unexpectedly on Edinburgh, which, in spite of their resistance, they found it necessary to preserve from her violence, by concluding a treaty, by no means so favourable to their wishes as their former success might have induced them to expect. The Queen, on the other hand, was the rather induced to defer hostilities, because she daily looked for the arrival of more troops from the continent. But the affairs of the Congregation, though critical, were far from being desperate at this period. A benefit even was gained by the Queen's recent advantages, inasmuch as they gave occasion to some of the chief adherents to the established religion, who had hitherto followed her, to perceive her design of reducing the kingdom to the condition of a province of France, which their patriotism could not tolerate. Thus the late regent, now the duke of Chatelherault, again changing his views, and the earl of Huntly, after the conclusion of the last treaty, promised the leaders of the Congregation, that in the event of their witnessing any farther deception, or a violation of faith on the part of the Queen, they would unite with their countrymen in efforts to preserve their national independence. Circumstances were not long wanting to require the fulfilment of this engagement.

On the accession of Francis II. to the crown of France, the family of the Guises, to which the Queen regent belonged, assumed the chief management of the affairs of that kingdom, and determined, with as much energy as might be required, to aid their relative in suppressing the Protestant religion, as one important step to their ambitious designs on England. For this purpose, they resolved to commence at home, by selecting a victim whose consequence might give the greater effect to the punishment which they meditated. This was the earl of Arran, eldest son of the duke of Chatelherault, who had long resided in France, where he commanded the Scottish guards, and where he had of late somewhat indiscreetly avowed his approbation of the new doctrines. But this nobleman taking alarm at certain expressions of the cardinal of Lorraine, made his escape into Scotland, where he communicated his sentiments and his indignation to his father, who, together with himself, soon afterwards joined the Congregation as their nominal head, James Stuart, prior of St Andrew's, a natural son of James V. being in reality their chief mover and adviser. This singularly able man merited that distinction and confidence, not more by the superiority of his talents, his military skill, and personal bravery, than by his resolute attachment to the principles of the reformation.

The arrival of some French troops relieved the Queen in part from her uneasiness at the loss of the duke. They were immediately employed in fortifying Leith, which gave great offence, and drew forth a spirited remonstrance from the lords of the Congregation. To this the Queen paid little regard. She proceeded even to an action still more odious, in direct contravention of the treaty agreed on,—the seizure of the church of St Giles in Edinburgh, which was again employed in the service of the Romish faith. It now appeared absurd to hope for redress, or any amicable proceeding from the Queen, and accordingly the protestants felt themselves compelled to take arms in their own defence. The Queen retired into Leith, already sufficiently fortified to withstand an army unprovided with the requisite artillery for prosecuting a siege; here she endeavoured, by various artifices, to weaken or divide the force which threatened her; and her labour was not altogether fruitless. But her subsequent behaviour, when another remonstrance was presented to her, counteracted all the effects of her stratagems and insinuations. Her haughty declaration of independence, and an order to disband, on pain of treason, convinced the leaders of the Congregation that nothing but the most decisive conduct on their part could ensure their safety. They accordingly assembled all the principal persons of their party, and formed a convention, exceeding in number the ordinary parliament, in which they proposed the difficulties and dangers of their situation, and solicited the requisite direction and assistance. Here, after a short but solemn deliberation, in which Knox took an active part, as representative of his order, it was unanimously determined to deprive the Queen of the office of regent, a decree which was conveyed to her in a letter from the lords of the Congregation, couched in the most energetic and perspicuous language.

An unsuccessful attack on Leith, made after this event, occasioned great dissatisfaction and murmuring among the adherents of the Congregation. To allay these discontents and inspire new hope, it was resolved to apply to the English queen for assistance. Nothing could give Elizabeth more pleasure than such an opportunity of opposing the designs of her foreign enemies, or extending her influence in Scotland. She promised her support, and shortly afterwards sent a small sum of money, which unfortunately was intercepted on the way. This was a grievous disappointment to the reformers, and, to add to it, a skirmish with the French troops in the neighbourhood of Leith, was terminated very much to their disadvantage. They were now so much dispirited that they retreated hastily to Stirling, and their numbers began gradually to diminish. Another address to Elizabeth, through Maitland of Lethington, who had recently deserted the Queen-regent, and joined the Congregation, seemed the only remedy for their alarming difficulties. This was eminently successful, in leading to a treaty, which proved of the most essential service to their cause. In the meanwhile, the queen regent sent out some of her forces to ravage the county of Fife, as peculiarly obnoxious, from its general attachment to her opponents. These were cordially employed in the work of destruction, and were preparing to advance on St Andrews, when the unexpected appearance of an English fleet in the Forth, at first taken for a French reinforcement, obliged them hastily, and in a very wretched condition, to retreat to Leith by the circuitous route of Stirling.

A new era opened for the Congregation on the arrival of Elizabeth's promised aid. The Queen-regent sought refuge in the castle of Edinburgh, in a state of health which threatened her dissolution at no great distance of time; and the English army, under Lord Gray, laid siege to Leith, in which she had placed her chief support. Her death took place during the protracted operations against that fort; and at last there remained no chance of escape for the French troops but the acquisition of reinforcements from their own country, or the conclusion of a peace. The former was rendered impracticable by recent events at home; and, accordingly, negociations for the latter were entered into with all imaginable celerity. These terminated in the treaty of Edinburgh, formerly mentioned, which at once relieved Scotland from its enemies and its allies, and decided a long, arduous, and complicated struggle in favour of the reformation, which was subsequently proposed, discussed, and ratified by parliament. The proceedings of this assembly were communicated to queen Mary, still in France, and her husband Francis, by whom they were much disliked, and also to queen Elizabeth, whose political views ensured them a more favourable reception, though she rejected, on her usual grounds, a proposal for perpetuating the friendship of the two countries by her marriage with the earl of Arran.

The death of Francis gave no small joy to the Scots, as an event which promised the entire establishment of the protestant faith, and the acquisition of political liberty, without the interference of a foreign associate, clothed with the authority and influence of husband to their queen. The principles and outlines of the presbyterian church were now determined on the model of that which Knox had so warmly approved in Geneva, but with such modifications, and in as cautious a manner, as circumstances required. A convention of the estates, in which various ecclesiastical regulations were accomplished, finally resolved on inviting their queen, now a widow, and retired from the French court, to return to her native country, and assume the reins of government. She was received with demonstrations of joy, but with a paucity of pomp which little gratified her taste; and though permission for her exercising it was at last obtained, she soon perceived that only scanty indulgence would be allowed to her notions of religion, by a people who had contended so long, and so obstinately, against the superstitions and profane ceremonies of her faith. Yet with good guidance and moderation on her part, coupled with the affection and esteem of the nobles, it might have been reasonably expected that her reign would prove equally honourable and beneficial. Nor were some of her first measures calculated to destroy such a hope. She employed protestants exclusively in her administration, studied, at least for a time, to secure the good understanding of the English queen, dispensed justice in an impartial manner, and contributed to the refinement, if not the comfort of her subjects. If it be impossible altogether to justify her subsequent behaviour, or with propriety commend her character, it is no less so to withhold some lenient consideration for the number and magnitude of the difficulties with which she was beset. Her youth and inexperience, the prejudices of her education and early habits, the allowable foibles, or at least pardonable infirmities of her sex and station, judged of in relation to the new and extraordinary exigencies of the times, and the natural or superinduced peculiarities of her subjects, present every adequate reason for moderating censure, though they may not exempt her from an unfavourable verdict.

The dissensions and jealousies of the nobility were among the first difficulties which she had to encounter. Her favour for the prior of St Andrews, whom she created earl of Murray, excited umbrage in the duke of Chatelherault and the earl of Huntly, which had very unhappy effects. Then a disturbance arose at Edinburgh about her religion, which threatened disagreeable consequences. But a still more serious difficulty presented, in the choice of a proper person for her consort. Several suitors proposed themselves, or were proposed by others for her acceptance, and of course with various degrees and kinds of advantage. Her deliberations on the subject merit the praise of attention to the interests of her subjects, although it be very questionable if her decision were as much calculated to promote them, as it seemed to gratify her fondness for personal accomplishments. A powerful party highly disapproved her preference of the lord Darnley; and the earl of Murray, in particular, manifested his dislike and objections in a manner very offensive to her feelings and pride. This nobleman was at last obliged to take refuge in England, where the crafty Elizabeth, who had in reality concurred in his opposition for her own ends, treated him and his associates with public indignity, but at the same time privately supplied them with money, and interceded in their behalf.

Mary, so far successful against that able man, reconciled the people to her choice, created her youthful husband king of Scotland, and proceeded to levy fines on such of the towns as had shewn adherence to her banished opponent. She afterwards relented in her intentions respecting him and his friends, notwithstanding the obdurate disposition of her husband, and absolutely agreed to recal them and treat them with gentleness, when the arrival of a French embassy, charged with solicitations to enter into an alliance for the extirpation of protestantism, changed her resolution, and in reality the whole plan of her administration. Her rash engagement in this abominable scheme, was the origin of most of the perplexities and miseries which she afterwards experienced. The revolution in her sentiments and political views was immediately manifested, but soon received interruption by an event, apparently of a private, and, excepting the guilt and barbarity of the

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actors, a trivial nature, but which may be justly considered as instrumental in preserving both Murray and the protestant cause from destruction.

Darnley, a man of weak judgment, but of strong passions and vicious habits, soon perceived the diminution of his royal consort's love and esteem. This altered regard his jealous imagination ascribed to an undue fondness for one Rizzio, an Italian, whose skill in music and other qualifications had somewhat rapidly, though innocently enough, procured her approbation and confidence. The earl of Morton, lord Ruthven, and others, some of whom were on different grounds inimical to this foreigner and favourite, concurred in Darnley's suspicions, and entered with him into a plan for the murder of their victim. This they effected in a savage manner, in the palace of the Queen at Edinburgh, almost before her eyes, and without the smallest regard to her entreaties, or her delicate condition of pregancy. After this horrid deed, the conspirators, who had farther objects in view than the gratification of personal hatred, took possession of the palace, and set a guard upon the Queen. Darnley, moreover, prohibited the intended meeting of parliament on the day appointed, and took measures for preventing disturbances in the city. Murray and his associates, apprized of the resolutions against Rizzio, arrived there in the following evening, and were afterwards graciously received by the Queen, who hoped, by their means, to induce her husband to act against the very persons by whom, partly at his instance, the blood of her domestic had been shed. In this she perfectly succeeded,—that foolish and headstrong youth abandoning his accomplices, who fled into England, and being audacious and weak enough to issue a proclamation, in which he denied all participation in their crime, though in a manner calculated more powerfully to convince her of his guilt.

But no acquiescence in any of her measures could ever restore to Darnley the lost affection of his consort, or remove the disgust and aversion which his meanness and odious practices excited. It was impossible for him, at last, with all the privileges and the rank of royalty, to retain authority, or command even the semblance of respect among the usual retainers of a court. The birth of a son, afterwards James VI. an event which might have been thought likely to reconcile and cement the union of the parents, had no such salutary effects. Mary, unfortunately alike for her happiness and her reputation, besides having irrecoverably steeled herself against him, had gradually opened an avenue for the approaches of a more insinuating personage. The earl of Bothwell, a man of talent and address, but dissolute and ambitious, had, by various services, merited the gratitude of his queen, who did not fail to testify it by sundry rewards, and the ascendancy in her councils. In a heart so susceptible of tender and kindly emotions, and so grievously disappointed in the object of its love, it is not improbable that feelings of a warmer nature speedily arose, and that the confidential adviser of Mary, became, in no long time, the master of her affections, though there be no evidence of criminality of conduct between them, on which any thing like conviction can be founded.

The designs of Bothwell became elevated with his success, and ultimately carried him beyond the most sacred bonds of allegiance and humanity. Darnley, perceiving his complete and irremediable degradation, formed a notion of leaving the kingdom, which was with much difficulty prevented from being put into execution. He was afterwards taken dangerously ill at Glasgow, but received no attention from his consort, perhaps in retaliation for the neglect she had before experienced during her own indisposition at Jedburgh, or perhaps owing to the nature of his disease, which in those days was imagined so contagious, that persons labouring under it were removed without the walls of cities. But her conduct was visibly and strangely altered on his becoming convalescent. She then visited him, and manifested such concern for his welfare, as can scarcely be reconciled either with her former indifference and contempt, or the notion that she was in no respect practising on his credulity, in order to forward the fate which awaited him. Be this as it may, it is certain that she succeeded in inducing him to return to Edinburgh, in the immediate neighbourhood of which a retired place was prepared for his reception. Here she continued to wait on him with becoming care for some days, though, at times, partaking of the amusements of the palace. It was on one of these occasions, that, early in the morning, the house in which Darnley lay was blown up with gunpowder. The alarm of the explosion soon brought the inhabitants to the spot, when the bodies of that unfortunate man and the servant who usually slept in his room were found lying in an adjacent garden, dead and naked, but without any marks of violence, or the least appearance of having been touched by the fire.

A deed so atrocious and so decisive, naturally excited popular suspicion, which glanced, with no qualified force, on Bothwell, if not also on the Queen. Their subsequent behaviour afforded confirmation to the charge, and assuredly manifested every inclination to profit by the catastrophe. A trial, at the instance of Darnley's father, declared the former not guilty, the accuser finding it unsafe to make his appearance, and the judges being previously instructed how to proceed. Bothwell afterwards constrained a party of the nobles to forward his views on the Queen, whom he seized on the road to Stirling, probably by concerted arrangement, and carried her to Dunbar castle, where she yielded to his ardent solicitations, and accepted him for her husband. They were afterwards publicly married, Bothwell having obtained a divorce from his former wife, but not without very unequivocal manifestations of popular umbrage, and expressions, or appearances, of disapprobation on the part of all whose judgements were deserving of attention.

There now wanted only the title of king to make Bothwell's conquest complete. He possessed, in reality, regal power, and maintained entire sway over the will of Mary. But his triumph was of short duration. His efforts to acquire possession of the infant prince were abortive, through the manly and loyal behaviour of the earl of Marr, to whom he had been committed. His haughty carriage, and the reiterated reproaches of foreigners, who were univer-

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sally struck with horror at the transactions which had recently taken place in Scotland, at last roused the nobility to some spirited resolutions. A combination against both was the result, by which, after some shew of resistance, and only a month after their marriage, Mary was obliged to surrender herself to the confederates, and her paramour, with a few adherents, rode off the field, where he had vainly endeavoured, with her co-operation, to urge their army to battle in their behalf. The Queen was now conveyed to Edinburgh, more like a culprit than a sovereign, and entered it in a state of fatigue and wretchedness which failed to excite the slightest emotions of compassion or sensibility among the people, the surest of all indications of the abhorrence and dislike in which her conduct was generally viewed. Nor did the confederates stop here. They proceeded to still more vigorous measures, as requisite for their own safety, and the welfare of the kingdom. Having first of all confined the Queen a prisoner in Lochleven castle, they, in the next place, notwithstanding some opposition on the part of several of the nobility, compelled her to resign the crown in favour of her infant son, and appointed the earl of Murray regent. A meeting of parliament confirmed these deeds, and declared the imprisonment of Mary to be legal. She afterwards made her escape, and, collecting some of her friends, ventured unsuccessfully to engage the army of the regent at Langside near Glasgow. On her complete discomfiture in this last struggle, she fled into England, where, after a long captivity, she terminated her days at the block, as already related. Thus was accomplished a revolution almost unparallelled in history, for the expedition, limited means, and nearly bloodless efforts with which it was prosecuted. The wretched Bothwell, one of the chief actors in this extraordinary drama, fled from place to place, a vagabond, destitute, deserted, despised; become a pirate for subsistence, he was captured by the Norwegians, saved from an infamous death merely by his more infamous notoriety, but consigned to perpetual and rigorous imprisonment, where he languished for ten years, a prey to remorse, melancholy, derangement, and despair, and where he ended his ignoble life, without an eye to pity his miseries, a hand to relieve his necessities, or a heart to respect his memory.

James VI. A. D. 1567.—The vigorous regency of Murray was of short continuance, but it secured the authority of the young king, and effectually subdued the party which remained attached to Mary, without any remarkable display of severity. His proceedings against that princess herself, during the singular conference which undertook to investigate her conduct, are less easily explicable to his advantage. On his death by assassination, the Queen's friends revived their hopes. They obtained possession of Edinburgh, and projected a war with England, in behalf of their captive sovereign. But the king's party, assisted by Elizabeth, ultimately prevailed, and, at her suggestion, appointed the earl of Lennox to the vacant regency. The kingdom at this period was distracted by factions of various kinds, in which it was no nowise unusual for members of the same family to take opposite sides, and contend with rancorous animosity. Lennox was one of the sufferers in an assault on the king's party, during its sitting in parliament at Stirling, and was succeeded by the earl of Marr, whose patriotic spirit and virtuous behaviour deserve the highest encomium. Disappointment at the failure of his project for a general peace, greatly through the ambition and avarice of the earl of Morton, terminated his life, with the esteem, if not the affection, of all parties. To him succeeded that able nobleman, who was supported by the queen of England, in opposition to the fears and jealousies of the people. The commencement of his regency was marked by a singular innovation in church government, which had more for its object, at least in the first instance, the advantages of the nobility, not forgetting Morton himself, than the welfare of the community. This was the appointment of ecclesiastical officers, according to the principles of the episcopal establishment, but privately subject to a kind of copartnery, by which the patrons reaped the chief temporal advantages of the respective sees. John Knox lived long enough to witness this gross vitiation of a system for which he had so long and so energetically contended.

Morton now laboured, not without success, to compose some of the differences which agitated the kingdom. But his measures partook too much of the covetousness and severity of his character to give general satisfaction. The disorders and misery of the country became at last so great, that some of the nobles, who were disgusted at his administration, prevailed on James, now twelve years of age, to deprive him of his office, and undertake the concerns of government. Morton, apprised of their intentions with respect to him, resigned the regency, and retired to one of his seats, but watched for an opportunity of recovering his authority; and this soon offered; for the possession of the king's person gave him a decisive advantage over his opponents, which he did not fail to improve. But there soon arose new obstacles to his enjoyment of power, in the two individuals whom James now singled out as his favourites and companions. These were, Esme Stewart, a member of the Lennox family, and James Stewart, the second son of Lord Ochiltree. Their efforts against him completely succeeded, notwithstanding his own influence and the mediation of queen Elizabeth. He was accused of the murder of lord Darnley; tried in a hasty, irregular manner, by a jury of his enemies, and on evidence partly extorted from the witnesses; the result, of course, justified the means used to accomplish his ruin; and he was condemned and executed.

The imprudent proceedings and undue influence of the favourites, now excited universal uneasiness; a party of the nobles united to free James out of their hands; and this object they accomplished somewhat rudely, by seizing him during his entertainment at Ruthven-castle, whence this singular enterprise has been called *The Raid of Ruthven.* But this deed, violent and hazardous as it was, the king was obliged to approve; and it afterwards received the most favourable interpretation from an assembly of the church and the convention of estates. James, however, who had only dissembled, afterwards escaped from the conspirators, whom he required to deliver themselves prisoners, on pain of being guilty of high treason, and whom, in defiance of his promises and engagements, he treated with unbecoming and very impolitic severity. This was owing to the ascendancy which one of his favourites again acquired over him, whose profligate manners and violent counsels justly roused indignation and abhorrence throughout the country. Odious as the conduct of the king, thus biassed, had proved, it was rendered still more irritating by his interference in church concerns, and his behaviour to the clergy, most of whom disgusted, offended, and injured in their rights, forsook their charges, and fled into England.

Elizabeth, in order to guard more effectually against the adherents of Mary, thought proper to court a good understanding with James's favourite, now the earl of Arran. This enabled him to proceed with more activity against those nobles and their friends who had formerly been banished. They were accordingly attainted and their estates seized by that worthless creature and his associates. But in course of time, it became no less for the interest of the English queen, or at least the success of her projects, to undermine the power of this individual, and to assist the objects of his vengeance. For this purpose she gained over the needy James to her views, and concluded an alliance between the two kingdoms in defence of the protestant religion. The banished lords now returned to their country, were reconciled to their sovereign, and witnessed the downfal of their opponent, the favourite, who was stripped of his honours and dishonest gains, and declared an enemy to the state. Still the clergy were little considered, and obtained scarcely any redress of their grievances; a neglect partly owing to James's obstinacy, and partly to a breach of promise in those who now came into power. Soon afterwards occurred that conspiracy against Elizabeth, the detection of which served as a fit opportunity for accomplishing the removal of her royal captive. James, who had, not long before, written a cruel letter to his mother, in which he refused to own her as queen, or in any measure connect his interest with hers, interceded in her behalf, and even threatened a rupture if his solicitations were not regarded,—a spirit in which, to their honour be it recorded, his nobility shewed a hearty concurrence. But the artifices of Elizabeth prevailed, both in executing her ungenerous purpose, and in preventing any consequent explosion on the part of Scotland. Indeed, it is to the credit of that queen's politics, though it imply little heroism in her contemporaries, that no prince had resolution enough to avenge a fate, which, with the exception of her own panic-struck and deluded subjects, was universally deplored.

James now endeavoured, with greater humanity and politeness than success, to reconcile his nobility to each other. A more efficient measure was the care of parliament to ratify all the laws in favour of the protestant religion, which had passed since the reformation. This was followed by the annexation of the church lands to the crown, which afforded only a small aid to the necessities and foolish liberality of the king. A change was also made, at the same period, in the civil constitution, which deserves notice. This was the revival of an act of James I. dispensing with the personal attendance of the *lesser barons* in parliament, and appointing the election of two commissioners from each county, as their representatives. This was opposed by many of the nobility, whose authority was thereby diminished, but was at last carried into effect, and henceforward the commons of Scotland sent representatives to parliament. The good sense thus displayed in James's administration continued in the friendly part he took with Elizabeth, against the designs of the Spanish king, now intent on the invasion of England. He resisted the solicitations of Philip in a manner which left no room to doubt the sincerity of his attachment, or his conviction that the subjugation of that kingdom by a foreign power could never profit, but might be fatal to the sister country. The resentful intrigues of Philip, after the destruction of his far-famed Armada, gave rise to a conspiracy among the popish nobles against the Scottish king; but it was fortunately discovered in good time, and afforded another opportunity to James for shewing the moderation and lenity of his character. A short imprisonment was all the punishment awarded to the leaders of this criminal association.

Relieved from his apprehensions either of foreign or domestic foes, James resolved on an event which might perpetuate the crown in the direct line of the royal blood. In spite of the opposition of Elizabeth, who seems always to have disliked any measures which promised greater security to the house of Stuart, he fixed on Anne, the eldest daughter of the king of Denmark, as his consort, and, on the occurrence of a storm which drove back the fleet intended to bring her to Scotland, actually fitted out some ships and went in quest of her. He arrived safely in Denmark; the marriage was solemnized; and he afterwards passed several months at Copenhagen. The kingdom enjoyed perfect tranquillity during his absence, all ranks appearing to vie in demonstrations of loyalty and attachment. One of his first acts on returning home, testified his gratitude for the fidelity and good services of the clergy, during the time of his being abroad. After commending the discipline and doctrine of the church, and promising inviolably to adhere to both, he permitted an assembly to take such steps as would abolish every vestige of episcopacy, and lay the foundation for the presbyterian model, which soon obtained all the formality and sanctions of a legal establishment. But these concessions, it is certain, were far from being agreeable to the feelings or opinions of James, who disliked a system which savoured so much of a republican nature, and many of the members of which were more remarkable for staunch adherence to their own notions of propriety and moral virtue, than those graces and that courtly deportment which are in general so requisite to secure the approbation of royalty. The remainder of his reign in Scotland was chequered with contentions in which they took an active part not much to the honour of their moderation, and naturally enough calculated to excite disgust in a mind even less pertinacious and conceited than that of James. It was marked also with various plots and

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conspiracies, partly owing to his excessive lenity towards offenders, and partly to the turbulence and disaffection of some of the nobles. That one known under the name of *Gowry*, was of a very peculiar nature, and has often exercised the ingenuity of historians. In the latter years of queen Elizabeth, he was careful to improve his interests in the English court; and on the death of that princess, who declared him her successor, after an affectionate farewell to his ancient people, he prepared with gladness to assume the new and splendid honour which awaited him. His accession to the crown of England united the interests of the two kingdoms of England and Scotland, and henceforward their history is properly that of one monarchy.

Chap. III. History of Great Britain.

James I. 1603.—On the death of Elizabeth, James VI. of Scotland succeeded to the throne, and was the first of that name who reigned in England. Notwithstanding the animosities which had long subsisted between the two kingdoms, all ranks among the English united in hailing his accession with demonstrations of joy. But his imprudent partialities in bestowing his favours, and his suspected predilection for his Scottish courtiers, rendered his popularity of short duration. Scarcely had he arrived in London when a conspiracy was formed against him, with a view to transfer the crown to Arabella Stuart, a near relation of his own, and equally with himself descended from Henry VII. Of the conspirators, who, excepting Parkham, were all convicted of high treason, Sir Walter Raleigh was condemned, on incompetent evidence, to many years confinement in the Tower before he suffered.

The puritans, who had been greatly oppressed during the reign of Elizabeth, welcomed James to the throne as an event auspicious to religious liberty; thinking that, as he was the king of a presbyterian nation, he could not fail to promote, or at least to tolerate the ecclesiastic system which they had embraced. In this, however, they were soon undeceived; for, induced by their growing disputes with the church, James, in 1604, called a conference between the parties at Hampton-court, when he evinced, by the share which he took in the controversy, his decided aversion to what he considered the republican principles of the puritans. On this occasion he defended his favourite maxim, "No bishop, no king;" and so pleased were the established clergymen present, that bishop Whitgift, one of their number, said, he verily believed the king was inspired.

Nor were the Roman catholics less disappointed in not receiving that religious indulgence which they anticipated under James, the son of their avowed friend, Mary, the Scottish queen. Prompted by motives of revenge, they devised a scheme, the most barbarous and inhuman which the annals of history have recorded; they determined to extirpate heresy from the land, by consigning to destruction, at the opening of the approaching parliament, in November 1605, the Lords, the Commons, and all of the royal family who were expected to attend. For this purpose, having hired the vaults under the houses of parliament, they secretly conveyed into them thirty-six barrels of gunpowder, which they carefully concealed among coals and faggots; and, to prevent all suspicion, boldly threw open the doors, that any person who chose might enter and examine the place. In the meantime, Sir Henry Percy, one of those embarked in the diabolical enterprize, addressed an anonymous letter to his intimate friend Lord Monteagle, beseeching him to keep away from the commencement of that session, "for God and man had concurred to punish the wickedness of the times." This letter was submitted by Monteagle to Lord Salisbury, secretary of state, who laid it before the king in council; and his majesty was the first to unravel its meaning, and to suspect the evil which it threatened. An order was given to search the vaults, and one Guy Fawkes, an officer in the Spanish service, was found about midnight, just when he had finished his preparations, with a match in his pocket to set fire to the train. This hardened wretch was immediately seized, and committed to the Tower; but from a sullen obstinacy, arising perhaps from the despair of pardon, refused to discover his accomplices, until his spirits were subdued by the exhibition of the rack, on which he was about to be tortured. Soon after, the conspirators, about eighty in number, were taken and put to death in different parts of the country.

England and Scotland, although now governed by one sovereign, had each a separate and independent parliament. James saw clearly the advantages which would result from their being united under one legislature; and in 1606 he turned his attention towards the promotion of this desireable object. But his proposal, notwithstanding it was supported by Sir Francis Bacon with all the energies of his powerful mind, met with determined opposition in the invincible prejudices of the Commons, so that the business was given up as impracticable at the time. Hitherto their influence in checking the authority of the crown had been so inconsiderable, that they deemed it unnecessary to record their transactions; and it was not until 1607 that the practice of keeping regular parliamentary journals commenced, when a motion was made to that effect by Sir Edward Sandys.

The speculative system of arbitrary power which James had adopted, was fully displayed in his first conference with his English parliament. While his ministers and courtiers seconded his views of absolute government, the Commons boldly resisted every attempt to annihilate their civil liberties. By his inconsiderate profusion he soon experienced pecuniary embarrassments; and in 1608 the lord treasurer Dorset stated his necessities to the Commons, who boldly refused to grant the wished-for supplies. In 1610, when, by commission, the earls of Suffolk and Salisbury opened a new session of parliament, money was again demanded, on this ground, among others, that L.350,000 had been absorbed in paying off the debts of Elizabeth. But this only produced a counter-demand on the part of the Commons, for a redress of the national grievances. The king was so displeased, that having admonished them "not to meddle with the main points of government that was his craft, nor to pretend to instruct a king who had been thirty years at the trade in Scotland, besides an apprenticeship of seven years in England," dissolved the parliament.

The year 1612 witnessed an improvement in the civilization of Ireland. Previously to this period enormities of the most criminal nature, such as murders, rapes, and robberies, were, by the *brehon* law, atoned for by fines, called *eric*, while, for oppression, extortion, and other less offences, no redress whatever could be obtained. James bent all his efforts to the abolition of this and similar barbarous customs, and so completely did he succeed, that, by substituting the English law in their place, and by keeping up a small, but well disciplined army, he exalted the country to a degree of moral amelioration, and composed it to a state of tranquillity to which it had hitherto been a stranger.

On the 6th November in the same year, an event took place which cast a melancholy gloom over the whole nation. This was the death of Henry, prince of Wales, in the 18th year of his age; a prince universally beloved, fond of martial exercises, possessed of splendid accomplishments, and free from those irregularities which too often, especially in the fervour and thoughtlessness of youth, follow in the train of rank and fortune. But the grief thus occasioned was, on the 14th of February following, in some measure removed by the marriage of the princess Elizabeth to Frederick, elector palatine; a marriage which by no means proved fortunate either to the king or his son-in-law.

James having convoked his second parliament in 1615, for the purpose of recruiting his treasury, which had been considerably exhausted by the sums which had been lavished on his worthless minion, Robert Carre, met with a spirited and steady resistance from the Commons. Instead of listening to his request, they again demanded a redress of grievances; and he became so provoked, that he dismissed them without obtaining his object. The king, however, was not to be driven from his notions of absolute power. One day he put the question to two of his courtiers, whether, laying aside the formality of parliaments, he might not at any time take the money of his subjects to supply his necessities? "God forbid," replied Neale, bishop of Durham, "but that you should; for you are the breath of our nostrils." This question being next proposed to Andrews, bishop of Winchester, he answered, "Your majesty might lawfully take my brother Neale's money, because he has offered it."

In 1617 James visited his native country with the view of establishing in that kingdom the English hierarchy, of which he was a strenuous supporter. Before this the episcopal form of worship was there but partially acknowledged, and the feeble authority of the Scottish bishops had always met with a powerful counteraction in the zeal and exertions of the national presbytery. The king having called an assembly of the subservient ecclesiastics, obtained a declaration that the following articles, commonly termed "the five articles of Perth," the place where that assembly was held, should in future form a part of the Scottish ritual; namely, 1. The use of the cross in baptism; 2. Confirmation; 3. The observance of holidays; 4. The receiving of the Lord's Supper in a kneeling posture; and, 5. The administration of private baptism to infants. But these articles, which were ratified by a small majority of the Scottish parliament, were so offensive to the great body of the clergy, and of the people, that they were soon after rejected with disdain.

After thirteen year's imprisonment in the Tower, Sir Walter Raleigh obtained his release, though not his pardon, by giving out that he knew of a gold mine in Guiana, which promised immense treasures to the British nation. He accordingly embarked for the New World, with a force sufficient to overpower the Spaniards, who had formed a small settlement on the river Oronoko, not far from the spot where the riches were said to be found. On his arrival he sent a detachment on shore, who met with a bloody reception from the settlers; in the action his son was slain, and the town of St Thomas reduced to ashes. The other adventurers, thinking themselves duped by their leader, despaired of success, and, abandoning the enterprize, returned with him to England. The privy-council accused him of having abused the king's confidence; Spain demanded indemnification for the loss he had caused her to sustain; and James signing the warrant for his execution on his former sentence, this great man was, in 1618, beheaded in Palace-yard, Westminster.

The states of Bohemia, inspired with the love of religious liberty, in 1619 took up arms against the emperor of Germany, in defence of the protestant cause. Calculating on the relationship of the elector palatine to his Britannic majesty, and to prince Maurice, stadtholder of the United Provinces, the Bohemians made a tender of their crown to Frederick, who having incautiously accepted the offer, plunged himself into a disastrous war with a powerful enemy. He was defeated in the decisive battle of Prague, stripped of his new dignity, despoiled of the palatinate, and obliged to seek in Holland an asylum for himself and his family.

From an extreme reluctance to break with Spain, in consequence of a proposed match between the infanta and Charles, prince of Wales, James refused his son-in-law that assistance which his necessities required. The murmurs of the British nation, excited by their compassion for the suffering protestants, were loud and reiterated against the king for such callous neglect. Yet, in consideration of some money he remitted to Frederick, the Commons, in 1621, voted him considerable supplies. In return he redressed several grievances of which they complained; and the high chancellor, Francis Bacon, a man universally admired for the splendour of his talents, and the sublimity of his genius, was, for his bribery and corruption, fined L.40,000, doomed to imprisonment in the Tower, and declared incapable of holding any public office in future. But he was soon after relieved of the fine, restored to liberty, and permitted to retire on a pension of L.1800 a-year. The Commons, however, in the plenitude of their zeal, proceeded to such minute examination into abuses, that the king becoming jealous of his prerogative, dismissed the parliament with expressions of the greatest displeasure.

Next session, in the same year, the Commons, indignant at the indifference of James to the situation of his son-in-law, and to the protestant interest in Germany, remonstrated with him against the intended marriage of prince Charles with the infanta of Spain. The king replied, that they had not understandings to scan his measures, and that it did not belong to them to meddle with the deep matters of state, excepting when he chose to ask their opinion. This reply produced a protestation, in which they maintained that "the liberties, franchises, privileges, and jurisdiction of parliament are the ancient and undoubted birth-right and inheritance of the subjects of England;" a protestation which he in a rage tore with his own hands from the journals of the house, and ordered his reasons to be inserted in the council-book. Having imprisoned the leading members in opposition, he dissolved the parliament. From the date of these transactions, politics became a favourite subject of discussion throughout the nation; those who took the side of liberty were, for the first time, distinguished by the name of *Whigs*, and those who supported the regal authority were denominated *Tories*.

The elector palatine began, in 1622, to make some efforts for the recovery of his dominions. But James, who, for his pusillanimity, was contemptuously depicted sometimes as wearing a scabbard without a sword, and, at other times, as having a sword, which many hands pulling at it were unable to unsheath, prevailed on his son-in-law to desist from the unavailing enterprise, and to trust for the accomplishment of his object to the efficacy of his negociations. The pacific king rested the success of these negociations on the mediation of Spain; and, in order to induce the Spanish monarch the more readily to enter into his measures, by hastening the projected marriage, he made some concessions in favour of the catholics in England. Matters were now in a fair train of settlement, when the hopes of James were completely blasted through the imprudent interference of his favourite Buckingham, who, anxious to remove the coldness which had taken place between him and the prince of Wales, and envious of the reputation the earl of Bristol had acquired in managing affairs with Spain, proposed to Charles a romantic journey of courtship, which admirably accorded with the ardour of his youthful mind. This was to visit the continent, and pay his addresses to the infanta in person. The two chivalrous heroes set out on the 27th February 1623, Charles as a knight-errant, and Buckingham as his squire; and having passed through France in disguise, under the assumed names of Jack and Tom Smith, they arrived at Madrid on the 17th March, where they were received by the Spanish king with the most hospitable and flattering attentions. But this kindness was ill requited by the perfidy of Charles, who, after a stay of nearly eight months, returned to England, with a determination to break off the match which had been so long negociating.

This dishonourable conduct of Charles may be ascribed partly to his having fallen in love with the princess Henrietta in his way through France, and partly to the specious arguments of Buckingham, who hated the Spanish nobility, by whom he was detested in return for his impetuosity of temper and his indecent and dissolute conduct. James entered reluctantly into the views of the prince and the favourite; and the earl of Bristol, after some manœuvring on the part of government, was recalled to England, and committed a prisoner to the Tower. The king of Spain, indignant at the idea of being deceived by such shameful prevarications, ordered the infanta to lay aside the title of princess of Wales, which she had now assumed, and to think no more of Charles for her husband. This rupture led his Britannic majesty to summon a new parliament for supplies in 1624; and the Commons, who were far from being adverse to the intention of hostile operations against papists, voted a considerable though an inadequate sum. War being now declared against Spain and Austria, 6000 men were sent over to Holland to serve under the prince of Orange.

In the meantime, a negociation was entered into for a marriage between the prince of Wales and Henrietta princess of France. The English court having agreed to the proposed terms of catholic toleration, the treaty was signed at Paris on the 16th November; and nothing was now wanting but a dispensation from Rome authorising the match. In this treaty it was stipulated, that an addition should be made to the ecclesiastics in the service of the princess; that a jointure should be settled on her of 60,000 crowns a-year, and that she should be entrusted with the education of her children until they respectively arrived at 13 years of age. There was also a general promise, that the English troops should have a passage through France, and that they should receive the co-operation of the French in restoring Frederick to the palatinate. On the faith of this promise, 600 men, under count Mansfieldt, were embarked for Calais; but they were not permitted to land, in consequence of no orders having arrived from the French government for their admission. They next sailed towards Zealand, one of the united provinces of Holland, where, before disembarkation was allowed them, their numbers were so diminished and weakened by a pestilential disorder, that they were of little service in promoting the object for which they set out.

That the failure of this ill-concerted expedition had some destructive influence on the spirits and constitution of James, is not at all improbable. He was soon after seized with a tertian ague, which carried him off on the 17th March 1625, in the 59th year of his age, having reigned 22 years over England, and 58 over Scotland. In his character there was nothing great to elicit admiration, nor illustrious to command respect. His vanity was excessive; his pedantry disgusting; his generosity undistinguishing and profuse; he was learned without knowledge, ambitious without wisdom, arbitrary without power, and obstinate without firmness. Hence his parliaments received with little gratitude concessions which were rather extorted by fear than dictated by choice.

Charles I.—Charles, prince of Wales, now ascended the throne. Trained by his father to notions of absolute power, and guided, like him, by the counsels of Buckingham, he had ere long to struggle with the most determined opposition. His accession to the crown was hailed, indeed, with a general expression of joy throughout the nation; but, by the overstretching of his prerogative, and by his rash and impolitic measures, the storm which had been gathering under the former reign, continued to increase until it burst with violence on his devoted head.

Having on the 13th of June consummated his marriage with Henrietta, sister of the king of France, Charles, in order to obtain supplies for enabling him to prosecute his hostile operations against Spain and Austria, summoned a parliament on the 17th of that month. But the Commons, with whose concurrence the war had been undertaken, evinced the most insulting parsimony, by voting only L.112,000; a sum too paltry to meet the importance and urgency of the occasion. Eight ships, however, were soon fitted out; and, according to agreement, lent to Louis XIII. to be employed against the Genoese, the allies of Spain; but the sailors finding, on their arrival at Dieppe, that their real destination was to act against the Hugonots of Rochelle, refused to proceed, and, with their admiral, Pennington, who was likewise averse to the service, sailed back to the Downs. Through the misrepresentations of the artful Buckingham, by whom it was pretended, that the French king and his protestant subjects had come to terms of accommodation, the same fleet, which was a second time dispatched, again returned to England, with the full determination not to engage in a cause of which neither religion nor conscience could approve. The Commons applauded this conduct; raised more loudly their outcry against popery, and enacted laws for the stricter observance of the Sabbath; and the king perceiving, that, instead of obtaining supplies, he met with nothing but complaints, dissolved the parliament, on the ostensible ground of the plague at Oxford, where it was then assembled.

In the meantime, Charles, by forced loans from his subjects, equipped a fleet of 80 ships, and raised an army of 10,000 men, which being entrusted to the command of Lord Wimbleton, were sent against Cadiz, without being able to accomplish the object they had in view. The murmurs of the nation at such an arbitrary method of levying money, and the necessity of pecuniary grants, arising from the urgency and importance of his public engagements, induced the king, in 1626, to call a new parliament. The Commons voted him a supply, but declined passing the bill into a law till the end of the session, that they might constrain him either to renounce that supply or agree to the redress of grievances; and having proceeded to accuse Buckingham of high treason, they were severely reprimanded by the king for their animosity to the duke, the scantiness of their grant, and the manner in which it was made; and, in order to frighten them into his measures, he desired them to "remember that parliaments were altogether in his power, for their calling, sitting, and dissolution; and therefore, as he found the fruits of them good or evil, they were to continue, or not to be." Far from being intimidated, the Commons pressed their accusations against the favourite, scrutinised the different parts of the administration, and complained the more bitterly of abuses. The imprisonment of two of the members, and the dissolution of the parliament, were the consequences of this struggle.

Charles, in order to procure money, now granted a commission to compound with the catholics, so as to dispense with the penal laws to which they were subject, demanded a loan of L.100,000 from the nobility and the city of London; and ordered the counties and the capital to fit out a certain number of ships for his service. These unconstitutional expedients excited repugnance and disgust; and many individuals were thrown into prison for resisting such arbitrary impositions. Although, in general, their release was obtained on petitioning the crown, yet some insisted on their liberation, not as a favour, but as a right secured to them by the laws of their country; and Sir Thomas Darnel, Sir John Corbet, Sir Walter Earl, Sir John Hewingham, and Sir Edmund Hampden, who had their cause solemnly pleaded before the Court of King's Bench, and who, after the bail they offered was refused, were remanded to their confinement.

On the eve of these transactions, Charles, through the imprudent counsels of Buckingham, who felt indignant at an affront he had recently received from Richelieu, prime minister of France, was induced, in 1627, to engage in an unsuccessful war with that country. The duke, with a fleet of 100 sail, and an army of 7000 men, was dispatched to Rochelle to join Soubise and Rohan, who headed the protestant or Hugonot faction. But being refused admittance within the gates by the inhabitants of the town, who were ignorant of the purpose for which he went thither, he directed his course towards the isle of Rhé; and, after making an inefficient attack upon it, returned to England, having two-thirds of his army destroyed.

The failure of this enterprise, not unjustly ascribed to the rashness and misconduct of that worthless minion, tended greatly to increase the murmurs of the nation; and in the parliament, which was summoned in 1628, the Commons not only adverted in strong terms to their past grievances, but shewed a determination to secure their properties and privileges against any future invasions. Accordingly, in the famous *Petition of Right*, which was now framed, they remonstrated against all arbitrary impositions and imprisonments. The Lords offered to pass the bill, if somewhat modified; but to none of their modifications would the Commons agree. At length, in hope of gaining five subsidies, which had been voted, it was carried through the Upper House, and the royal assent was with difficulty obtained. The Commons, not yet satisfied, proceeded to attack tonnage and poundage as oppressive and unconstitutional, and to inveigh against Buckingham as the author of all their grievances; but the king, seeing there was no end to their complaints, put a stop to their deliberations by proroguing the parliament.

The subsidies thus granted were needlessly squandered in sending ineffectual succours to Rochelle. A fleet went thither, and returned without accomplishing the object of its destination; and another was ready to sail under the orders of Buckingham, when this minion of royal favour was assassinated by one Felton, a fanatical and vindictive person, who served under him as lieutenant, and had met with disappointment in his hopes of promotion. The command of the armament now devolved upon the earl of Lindsay, who, instead of affording any relief to the besieged inhabitants, arrived just in time to witness a surrender to their catholic countrymen. After the death of Buckingham, Charles began to shew more moderation in his views of power and prerogative; but the boldness and enterprise of the Commons were so far from being diminished, that they increased their clamours against tonnage and poundage, and declared those who levied, and those who paid those duties, together with Papists and Arminians, enemies of the state. Provoked by their conduct, the king, in 1629, dissolved the parliament, with the resolution never to call another; and being inadequate, from the slenderness of his means, to prosecute the war in which he was engaged, he concluded a peace with France and Spain in 1630.

Charles still continued to harass his subjects with bold invasions on their liberty. He imposed on them arbitrary duties and taxes; authorised the odious transactions of the star-chamber, and the court of high commission; and permitted Laud, bishop of London, to employ even violence, in introducing into the church new ceremonies, which the Puritans, who now composed the majority of the nation, detested as papistical and superstitions. Indeed he conducted himself as a monarch convinced that absolute authority was lodged in his hands, and that the privileges of his subjects were grants from him, which he could recal at his pleasure. In June 1633 he visited Scotland, where he was crowned with solemn pomp on the 25th of July; and on his return to London he raised Laud, an audacious zealot, and keen supporter of his absolute measures, to the archiepiscopal see of Canterbury.

Intent on accomplishing the work begun by his father, the introduction of the same rites and hierarchy into both kingdoms, Charles, scorning to convoke assemblies, in which he might meet with opposition, resolved on reforming the church of Scotland by the mere dint of his authority. For this purpose he caused to be published, in 1635, canons on ecclesiastical jurisdiction, and a liturgy differing only in a few particulars from that of the English church, and ordered that the service should be performed in St Giles', Edinburgh, on the 23d July 1637. The indignation of the Scotch was now roused, and when the dean, clothed with his surplice, entered the desk, they were thrown into an uproar, crying out, "a pope, a pope, antichrist, stone him." The bishop ascended the pulpit, and by the most gentle persuasives endeavoured to appease the tumult; but this only enraged the people the more, who, to express their determination to listen to none of his speeches, hurled their stools at his head.

Presbyterians of all ranks flocked to Edinburgh, and combined in order to resist all religious innovations. But in place of desisting from his purpose, Charles had the imprudence to push his enterprize. Opposition to his measures soon became general throughout the kingdom, and the inhabitants, who were contending for what they considered dearer to them than life, formed themselves into four Tables, the first composed of the nobility, the second of the gentry, the third of the clergy, and the fourth of burgesses. In these Tables the whole power of the country was lodged, and one of their first acts was their entering into a covenant, in which they solemnly engaged to renounce popery, to guard their religious rights from all invasions, and to unite their power for mutual defence.

Charles, perceiving the bad consequences of his despotic conduct, was now willing to make some concessions. He accordingly promised the presbyterians, by the Duke of Hamilton, that if they would retract the covenant, he would suspend the use of the liturgy in Scotland. But they replied, in a tone the most prompt, that they would sooner renounce their *baptism*; and, determined not to rest satisfied with any thing short of the entire subversion of the hierarchy, they abolished episcopacy, the high commission, the articles of Perth, the canons, and the liturgy, in an ecclesiastical assembly held at Glasgow in 1638. The whole country was now called upon to sign the covenant; and the presbyterians, thus combined, prepared to take up arms for the protection of that system of church discipline and worship to which they were attached. Hostile preparations were also made on the part of the king; and the two armies having come within sight of each other, the popular party encamping on Dunselaw, and the royalists at Berwick, agreed, in 1639, to a pacification on certain conditions, which neither intended to observe.

Charles, from the exhausted state of his finances, had contracted considerable debts; and being unable to prosecute his designs against the Scots, convoked, in 1640, after an interval of eleven years, a parliament for supplies. His demands the Commons answered only by complaints. Chiefly composed of Puritans, who were strenuous advocates for religious liberty, and far from viewing the Presbyterians as enemies to the state, they could not lend their countenance to measures which proceeded on an overstretching power, and tended to annihilate one of the dearest privileges of man. The king dissolved the parliament, and had recourse to other expedients. By grants from the clergy, loans from his ministers and courtiers, and extortions from those who were unwilling to give, he was enabled to raise a considerable army. Before his forces could be put in motion, the covenanters had advanced to the frontiers of England, and pushing southwards, they soon took possession of Newcastle. But since it was not their intention to make war against the English, they drew up an address to Charles, praying that he would advise with parliament, as to the most effectual means of alleviating their distress. Urged by the city of London, and indeed the voice of the whole nation, as well as by the want of money, the undisciplined state of the army, and their backwardness to march against the Scots, he was obliged to listen to the above petition; and on the 3d November 1640, he summoned his fifth, which has been emphatically styled the *long parliament*. The republican spirit of the Commons led them to bold and decisive measures. They resolved on a reform of the government in all its parts; heard the complaints of individuals, of cities, and of counties; and, as one of their first acts, impeached Laud and Strafford of high treason. The Lords had now cooled in their attachment to the crown, and as Charles could put little confidence in their support, he began to make concessions. He agreed that the right of imposing tonnage and poundage should be invested in the Commons, and that the parliaments to be called in future should be triennial.

Besides these concessions, the king consented to a bill for the execution of the earl of Strafford, and to another for the perpetual continuance of parliament. The courts of High Commission and the Star-chamber, and all arbitrary impositions, were abolished, and the approbation of both houses was declared necessary to give the force of a law to ecclesiastical canons. Having concluded a marriage between the Princess Mary, and William, prince of Orange, Charles set out for Scotland, only to be despoiled of that small share of authority which remained to him in that part of his dominions. A parliament was immediately called at Edinburgh, in which it was enacted that no man should be created a Scottish peer who had not a rental within the kingdom of L.500 annually. Triennial parliaments were agreed to, without whose advice and consent no officer of state should in future be appointed. The king ratified the covenant; conformed to the Presbyterian church; bestowed pensions and preferments on some of the most popular preachers; and raised the earl of Argyle to the dignity of marquis, and general Lesley, and the Lords Loudon and Lindsay to the rank of earls.

While in Scotland, Charles received intelligence of a rebellion in Ireland. He bore this news with the greatest impatience, expressed his most decided abhorrence at the conduct of the insurgents, and employed every mean in his power to suppress them. On this occasion the Irish committed massacres aggravated by every circumstance of the most wanton cruelty, sparing neither age, nor sex, nor condition. Upwards of L.40,000 of the English are said to have fallen a sacrifice to their barbarous fury.

The power of Charles was now almost annihilated; and this appeared to be the moment for fixing the bounds of royal authority, and for securing the privileges of the nation. The struggle between him and the parliament had been gradually increasing, and the greater his embarrassments were, the bolder and more daring they became. Concluding that their presumption and insolence proceeded from his facility in granting their requests, he determined, on his return from Scotland, to make an example of some of the most violent. With this purpose he brought a charge of high treason against Lord Kimbolton, and five members of the lower-house, for endeavouring to subvert the constitutional laws of the country; and, on the 3d of January 1642, he foolishly went in person to demand those commoners of their own assembly. Not finding them present, he intimated a hope that the house would send them to him, as soon as they again appeared in their places, and then retired amidst the cry of "privilege! privilege!" from all quarters. On the day following, having left the Guildhall, whither he had gone to attend a meeting of the common council, that he might justify his intentions against the accused individuals, the seditious exhortation of one of the populace, "To your tents, O Israel," saluted his ears.

Reflecting on the rashness of his conduct, the king thought of making some atonement. He promised the Commons to desist from all proceedings against the obnoxious members; and having conceded to them the tower, and agreed that Hull, Portsmouth, and the fleet, should be intrusted to persons of their nomination, he was urged also to yield to them, for an appointed time, the disposal of the army. To this last request, after some deliberation, he at length replied, in a tone of exasperated feeling, "No, not for an hour." Being no longer in safety at London, he retired to York, where the people were more loyal; and as all friendly intercourse between him and his parliament had ceased, both parties resolved on deciding the contest by force of arms. The nation was now divided between two factions; those who took the side of parliament were denominated *round-heads*, and those who supported the interest of the crown were distinguished by the name of *cavaliers*. Hostile preparations being completed, the two armies met at Edgehill, in the county of Warwick, where they engaged in the work of death, and, after some hours of hard fighting, separated, leaving on the field 5000 slain, each losing nearly an equal number. The royal troops were re-inforced with soldiers and ammunition from Holland, and though less powerful than those of the parliament, the king judged it better to maintain hostilities, than to submit to the degrading conditions on which peace was offered him. For the first twelvemonth the war was on either side attended with various success, although the balance on the whole was in favour of the sovereign. During this campaign, John Hampden, and Lord Falkland, two of the greatest men of their respective parties were killed.

In 1643, the parliament, desirous of bringing the contest to a decisive issue, requested and obtained assistance from the Scots, who were not unwilling to give facilities to a measure which had for its object or tendency the abolition of the Episcopalian, and the establishment of the Presbyterian form of worship. The commons, who detested, and never ceased to humble the bishops, avowed their intention to new-model the church of England after the example of the sister church in the north; and the Scottish parliament ordered levies of troops and of money to aid in the attainment of so desirable an object. And, as a bond of union between the two countries in promoting their mutual aims, the solemn league and covenant was framed at Edinburgh. To assist him in preparing for the ensuing campaign, and to counteract the design of the Westminster parliament, Charles summoned a parliament at Oxford, which, abstracting from some supplies which they voted, was too feeble and inefficient to promote his views, and accordingly was soon prorogued, never more to be assembled. This is the first instance of two parliaments having met and deliberated at the same time.

After several petitions for peace, and after two or three thousand women of the city of London had gone in a body to the house of Commons, remonstrating against the war, and demanding the "traitors to be given them, that they might tear them to pieces," both armies again took the field in 1664. They drew up on Marston moor, forming together an assemblage of 50,000 men; and victory, which was long doubtful, was at length decided in favour of the parliamentarians, by the skilful and successful opposition which Oliver Cromwell, who now came into notice, made to the right wing of the royalists, commanded by prince Rupert. About this time archbishop Laud, who, since the beginning of the present reign, had been confined in the tower, was condemned and executed; and almost simultaneous with his death, was the abolition of the hierarchy and the liturgic service. In the parliament the presbyterians were the most numerous, and in the army the independents predominated. The former insisted on the privilege of having regular clergy, while the latter maintained this to be unnecessary, because every individual had a right to exercise the functions of the sacred ministry. Having insinuated themselves into office, the independents began to declaim against the corruption of the generals; and Vane harangued the Commons on the complaints of these preachers, remarked that all of them had held undesignedly the same language, and concluding that this agreement of sentiment must have proceeded from the inspiration of the Holy Spirit, exhorted the assembly, for the glory of God, and honour of the country, to set aside the consideration of personal interest, and to renounce all civil and military employment. Cromwell applauded his speech, and laboured to shew how advantageous it would be to follow the counsels which it proposed. This *self-denying* ordinance having passed, the earls of Manchester and Essex, with other noblemen, resigned their commissions. Sir Thomas Fairfax was meanwhile appointed general, and, in order to retain Cromwell in office, requested his advice and assistance in making ready for the approaching campaign. By an artifice, dictated by the most consummate ambition, Cromwell was soon raised to the post of lieutenant-general under Fairfax, although, by his daring and aspiring genius, contrasted with the ease and simplicity of his superior, the whole military power fell into his hands.

In 1645 the flame of war was rekindled in Scotland. The young earl of Montrose, who, from a determined enemy, had become a zealous friend to government, attacked and defeated the earl of Tullibardine with great slaughter at Tippermuir. His prosperous enterprises were only equalled by the celerity of his marches; and when the covenanters least suspected, they were doomed, by his movements, to the rigours and ravages of war. In successive engagements he overcame Lord Elcho at Perth, Lord Burley at Aberdeen, and the earl of Argyle at Inverlochy; and, after taking the town of Dundee by assault, he vanquished Ury near Inverness, Baillie at Alford, and another body of presbyterians at Kilsyth. As a reward for his services, Charles appointed him captain-general and deputy-governor of Scotland; but he was at length arrested in his career of conquest by lieutenant-general Lesley, in a splendid victory gained at Philliphaugh.

The fate of Charles was about this time decided in the south, by the battle of Naseby. The forces on both sides were nearly equal, and although a greater number of the parliamentarians than of the royalists were slain, yet Fairfax had taken many prisoners, besides the whole of the king's artillery and ammunition. The most of the strong cities of the kingdom being now in the possession of his enemies, Charles, beset on every quarter, retreated to Oxford, from which, when Fairfax, with a victorious army, approached, he escaped in the disguise of a servant, and sought protection from the Scots, who lay encamped before Newark. But such was the infamy of their conduct that, at the end of the year 1646, they surrendered him for L.400,000 to the English, who confined him in Holdenby castle, in Northamptonshire, and secluded him from all communication with his family and friends. A difference having taken place between the army and the parliament, the former sent a party of 500 horse to seize upon his person, and carry him off to their rendezvous near Cambridge. Being afterwards brought to Hampton Court, the king, despairing of bringing Cromwell over to his views, and finding his prospects daily darkening around him, withdrew to Tichfield, and then to the isle of Wight, where he was basely apprehended by the governor, and committed a prisoner to Carisbrook castle.

A faction, called the *levellers*, had arisen in the army. These fanatics rebelled against their officers, on the pretence that among the elect the most perfect equality was designed by the Holy Spirit. By prompt and vigorous measures Cromwell reduced the mutineers to discipline and obedience, and next meditated the destruction of royal authority, by bringing the sovereign to condign punishment for maladministration. But the time for the accomplishment of this object was not yet come. The parliament was negociating with Charles for settling the calamities of the nation, although unfortunately these negociations were attended with no happy results; for, while ninety-one members had principle and firmness to resist the military power, a majority declared it to be high treason for any person to correspond with him without the permission of parliament, a declaration which actually deprived him of the throne.

During these transactions, the Scots, in 1648, sent a powerful army into England, under the Duke of Hamilton, to liberate Charles from confinement, and to reinstate him in the authority and functions of which he had been despoiled. This only prompted the more decisive energies of Cromwell, who, defeating Hamilton, obliged him to surrender, and then invaded Scotland in turn, where he fully displayed his tyrannical and oppressive disposition. In the face of the military forces, who were now flushed with success, the Commons of England still attempted to close their treaty with the king, until colonel Pride, with two regiments, blockaded the house, and excluded all the presbyterian members, allowing admission to none but the most furious and resolute of the independent party. The appropriate appellation of *Pride's* purge was bestowed on this invasion of parliament, and the few that remained, when this purifying process was ended, were designated the *rump.* The unhappy monarch was conveyed from the isle of Wight to Hurst castle, in Hampshire, whence he was conducted to London, and after undergoing a mock trial before a tribunal of villains, among whom were Fairfax, Cromwell, and Ireton, was condemned, and beheaded opposite to Whitehall, on the 30th Jan. 1649, to the astonishment and regret of the nation.

Charles was thus removed from this world of troubles, in disregard of the most pathetic letters from the queen and the prince, of the protest and abhorrence of the Scots, and of the interposition of all the courts of Europe. In his character he displayed many excellent and amiable qualities, which were unduly estimated by his rebellious parliament. But having no just knowledge of the limits of his prerogative, he was led on by his ministers and courtiers to unwarrantable extensions of power; and his zeal for episcopacy, fanned by the advice of the bigotted and impolitic Laud, was one of the principal causes of his severe misfortunes.

Commonwealth, 1649.—After the death of Charles, the house of Commons, consisting of about four score madmen, abolished the house of Lords, and announced the final subversion of the monarchy. The whole nation was thrown into confusion, and various models of a republic were conceived, according to the respective views of the existing factions. In Ireland the duke of Ormond still defended the royal cause, and Cromwell went thither to oppose him with a numerous force. The most ample success crowned the efforts of this bold and intrepid warrior; the island was reduced into a state of subjection to the commonwealth, and upwards of 40,000 Irish fled into foreign countries, to escape the horrors of a brutal ferocity. On his return to London, Cromwell received the thanks of the house for his services in Ireland. A general was now to be chosen for conducting hostile operations in Scotland, where the marquis of Argyle and his partizans had proclaimed Charles II. son of the late king, as their sovereign; and Fairfax, who was partial to the presbyterian interest, declining the office, Cromwell was appointed in his place.

Information being communicated to Charles that the Scottish parliament had offered him the crown, he was induced, chiefly by the dreadful fate of Montrose, a faithful adherent to the royal cause, to accept it on the conditions prescribed. Having, in 1650, arrived in the Frith of Forth, under the convoy of seven Dutch ships of war; he was obliged to declare himself a presbyterian, and to sign the covenant, before he was permitted to land. He was soon afterwards invested with the regal power at Scoone, amidst the rejoicings of the people; but it was not long ere he found himself considered as little more than a mere pageant of state. In the mean time general Lesley took a position between Edinburgh and Leith, and avoided all the artifice of Cromwell to bring him to an engagement. Cromwell retreated to Dunbar, and was closely followed by Lesley, when, through the imprudent interference of the presbyterian clergy, a battle commenced, which terminated in favour of the English, who were but half the number of the Scots. In pursuing the vanquished, 3000 of whom were slain, and 9000 taken prisoners, Cromwell gained possession of Edinburgh and Leith. The royal army, which had formed entrenchments at Torwood, marched, by the persuasion of Charles, into England, though only 14,000 strong, in the expectation of re-inforcements from those who were friendly to their cause. Monk being left behind with 7000 men to complete the reduction of Scotland, Cromwell proceeded after the invaders with all possible expedition, came up with them at Worcester, and, with an army of 30,000, overcame them with dreadful slaughter. The royalists were all either killed or made captives, and the king, who was obliged to fly, passed through many adventures under different disguises, embarked at Shoreham, in Sussex, and arrived in safety at Feschamp, in Normandy, in 1651.

The Bermudas, Antigua, Barbadoes, Virginia, Jersey, Guernsey, Scilly, and the Isle of Man, were reduced into subjection to the commonwealth, and Britain now became formidable to the surrounding nations. Jealous of the growing trade and prosperity of Holland, she declared war against that country, passed the famous navigation act, prohibiting foreigners from importing any merchandize not the growth of their own soil, or the produce of their own manufacture, and obtained, under admiral Blake, a degree of naval glory to which she had hitherto been a stranger. This admiral distinguished himself in different engagements with the celebrated Dutch admirals, Van Tromp and De Ruyter. The parliament, extolling the advantages which they had gained by sea, complained of the expences incurred in supporting the land forces, and insisted on the necessity of disbanding some of the troops. Cromwell, who aspired at no less than sovereign authority, saw clearly that they intended to diminish his power, and anticipated their designs by dismissing them from the house. In 1653 he entered that assembly, accompanied by 300 soldiers, and, addressing himself to the members, exclaimed, 'For shame! get you gone; give place to honester men, to those who will more faithfully discharge their trust. You are no longer a parliament; I tell you, you are no longer a parliament; the Lord has done with you.' His next parliament was composed of the lowest of the people, who believed they had received the Holy Spirit in all his plenitude, declared universities and schools of learning to be pagan institutions, and proposed adopting the Mosaic code as the foundation of the republican constitution. The Dutch ambassadors who came to England to negociate a peace, were astonished at their ignorance and fanaticism; and Cromwell, ashamed of his work, dissolved this shadow of a parliament, and in 1653 received from the army the high title of Protector of the Commonwealth.

According to the plan of the new government, it was agreed that there should be a standing army of 30,000 men; that the protector should be invested with the right of administering justice, and of concluding alliances, declaring war, or making peace; that a council, consisting of not more than twenty-one persons, nor fewer than thirteen, should be appointed; and that a parliament should be summoned every three years, and should continue sitting for five months, without adjournment, prorogation, or dissolution. The British nation now acquired the empire of the sea, and, by the skill and bravery of Blake, Holland was obliged to yield to her the honour of the flag. A peace was concluded in 1654 between the Republic and the States-general; and a new parliament being called, it was, in consequence of its proceeding to discuss the assumed authority of the usurper, dissolved before the stipulated period of its duration had expired.

Having lost the confidence of the people, the usurper endeavoured to divert their attention from himself, by directing it to foreign enterprises. With a view to promote his ambitious designs, he compelled France to withdraw her protection from the unfortunate Charles, and formed with her a treaty, the conditions of which he himself haughtily dictated, and these cardinal Mazarine was ready to accept. In 1655 he broke with Spain, destroyed her fleet, and, by a squadron under the command of Penn and Venables, deprived her of Jamaica, one of the most valuable of the West India islands.

Scotland and Ireland were now united with England in one commonwealth. A council, consisting chiefly of Englishmen, had the administration of Scotland; and to Henry, the second son of the protector, the government of Ireland was intrusted. Believing his power sufficiently established, Cromwell, in 1657, summoned a parliament, which, after the suspected members were excluded, was disposed to forward his ambitious designs. Immediately on the rights of the house of Stuart being annulled, a bill was framed and passed for tendering to him the title of king; but though to this title he had long aspired, from the dread of conspiracies, or from deference to the advice of his friends, he declined accepting it. He was then confirmed in the protectorate, endowed with a perpetual revenue, and invested with the privilege of nominating his successor. The house, which had adjourned, was again assembled, when a majority declaring against him, he instantly punished their temerity by a dissolution.

In 1658 Cromwell lent Louis XIV. a body of 6000 men, to attack the Spanish dominions in the Netherlands, shared in the glories of that signal victory which marshal Turenne gained at Dunes over the prince of Conde, and, with twenty ships of war, blocked up the port of Dunkirk, which, having capitulated, the French put into his hands as the reward of his attachment. But, notwithstanding these successes, the usurper was unhappy. Conspiracies were formed against him, and a guilty conscience disturbed his repose. The terror and agitation of his mind brought on a slow fever, which terminated in a tertian ague; and, appointing his son Richard as his successor, he expired on the 3d of September in the 59th year of his age, and the ninth of his usurpation. In the relations of private life his virtues were conspicuous; his public character, which was distinguished for inordinate ambition, was yet tempered with humanity and justice; his pretensions to religion were great, while he laughed at the sectaries whose prejudices he had flattered; and, though unlearned himself, he was not unwilling to bestow the meed of literary merit. His age was adorned with the names of Usher, Milton, Waller, Cowley, and Clarendon.

The administration of Richard was of short continuance. He had neither genius nor resolution to support the fabric which his father had raised; and in 1659, after a cabal of the principal military officers, headed by Lambert, had been formed against him, he resigned his power, to live in the obscurity of peaceful retirement. The council of war, which was now left with the supreme authority, agreed to revive the long parliament, which, after the death of Charles, Cromwell had dismissed. This assembly, amounting to about seventy members, was so contemptible, that it received the designation of the Rump parliament, which discovering a disposition to thwart the republican measures of the officers, was soon destroyed, and an intention was formed of transporting the royalists to the West Indies. Amidst the confusion and alarm that ensued, General Monk conceived and executed the secret design of restoring the monarchy. While he still affected a zeal for the commonwealth, he was prevailed upon by a gentleman of the name of Morris, who alone possessed his confidence, to allow Sir John Granville to communicate with Charles, and desire him to repair, without delay, to Holland, where he should wait for farther advice. A new parliament was called, and Monk sounding the wishes of the members as to the settlement of the state, and finding them favourable to his views, desired the speaker to inform them, that one Sir John Granville was at the door of the house, with a message from the king. This message, which offered a general amnesty, promised liberty of conscience, and assured the soldiers of their arrears and the continuance of their present pay, called forth from all quarters bursts of rejoicing and applause.

Charles II. 1660.—Charles having landed at Dover, in a fleet which had been sent under Admiral Montague to bring him over to England, arrived in London on the 29th of May 1660, amidst the acclamations of the people. The contrast between his present state and his former adversities, combined with his manly figure and affability of character, excited universal interest in his favour. He was happy in the choice of his ministers; the earl of Clarendon was chancellor; the duke of Ormond, steward of the household; the earl of Southampton, high treasurer; and Sir Edward Nicholas, secretary of state. Two of the immediate instruments of his restoration, general Monk and admiral Montague, were honoured with marks of his gratitude and regard—the former was created duke of Albemarle, and the latter earl of Sandwich. Of the regicides, ten suffered with the confidence of martyrs; and the bodies of Cromwell, Ireton, and Bradshaw, were dragged from their graves to the place of execution, and doomed to sepulture under the gibbet on which they were hung. The parliament, all submissive and respectful, voted subsidies to the king, and fixed his revenue for all charges at the sum of L.1,200,000 annually; a revenue which far exceeded what any sovereign of England had before possessed. By the advice of Clarendon he disbanded all the troops, with the exception of about 5,000 men, who composed the first standing army under the monarchy which the annals of the kingdom record. He then dissolved the parliament with a most gracious speech.

Through the instigation of Clarendon, Charles, forgetting the compact on which he was recalled, and declaring that "Presbyterianism was not a religion for a gentleman," resolved, in 1661, to restore Episcopacy in Scotland. The Scottish parliament, equally compliant with that of England, granted him a revenue of L.40,000 for life, annulled the covenant as treasonable, and abolished every act which restricted the authority of the crown. Alarmed at these transactions, the presbyterians commissioned James Sharpe, one of their ministers, to manage their interests with the king; but this perfidious man abandoned their cause, and, as a reward for his treachery, was raised to the dignity of archbishop of St Andrews. The covenanters soon felt the vengeance of Charles; and the marquis of Argyle and the reverend James Guthrie, having undergone the most iniquitous trials, were condemned and executed, while others were committed to prison or consigned to banishment. Prelacy was sanctioned as the national religion,—the oath of supremacy and allegiance was enjoined,—and the recusant clergy were obliged to vacate their charges. In England an ecclesiastical transformation had likewise taken place; and the church being brought back to the state in which it existed previously to its change under the usurpation, an act of uniformity was passed in 1662, requiring the re-ordination of such ministers as had not been episcopally ordained, and their assent to every thing contained in the Book of Common Prayer, on the pain of ejection from their livings. Those who refused compliance with this act, and they amounted to 2000, were distinguished by the appellation of *non-conformists*.

About this time Charles married Catharine, the infanta of Portugal, who, besides the two fortresses of Tangier and Bombay, brought him L.500,000 as her dowry. Still, however, the revenue of the crown was, by his prodigalities, too slender to support the charges of the state; and, immersed in debt, he resolved to sell Dunkirk, which he accordingly made over to France for L.400,000. Induced by his prepossessions in favour of popery, he issued a declaration for softening the rigorous act of uniformity, and for granting a general indulgence. But his designs could not escape the penetration of parliament; and, in 1663, both houses concurring in a remonstrance against catholics, constrained him to drop his project of toleration. Four subsidies, the last taxes levied in this manner, were now voted him by the Commons.

Scotland was at present groaning under the yoke of prelacy. The presbyterian clergy in the southern and western parts of the kingdom were excluded from their pulpits; and, in consequence of this unprincipled exertion of power, the people, who could not in conscience attend the ministration of the new incumbents, were reduced to the necessity of going many miles to perform the public duties of religion, and ultimately of assembling in the fields for that purpose. As non-conformists, the covenanters were exposed to the exaction of heavy fines; and such was their determined adherence to their own system, that they were dragged with equal facility to church and to prison. In 1664, the inquisitorial and infamous court of High Commission was erected, an act was passed for suppressing conventicles, or private meetings for the worship of God; and, soon after, another followed for prohibiting the extension of charity to the suffering pastors who had been ejected from their livings. To shew the inconsistency of the instruments of regal oppression, it may be observed, that when the lord high commissioner Glencairn, and other persons of distinction and influence, apprehended the approach of dissolution, they wished to be attended in their last moments by presbyterian clergymen; a fact which led the duke of York to remark, "That he believed all Scotsmen, be what they would in their life, were presbyterians at their death."

The English parliament, prompted by a feeling of loyalty, repealed the triennial act; and the Commons, jealous of the flourishing commerce of Holland, persuaded Charles, by the offer of subsidies, which his extravagant dissipation had rendered indispensible, to declare war against that country. Under Sir Robert Holmes, a squadron of twenty ships was secretly dispatched, which deprived the Dutch of their African territories and of Nova Belgia, the present New York, in America. But about the beginning of the next year (1665), the famous De Ruyter recovered to the United Provinces their possessions on the coast of Guinea, and then retaliated on the English, by expelling them from some of their old settlements. Maritime hostilities immediately commenced between the grand fleets of the two nations; and different bloody engagements were terminated with various success, displaying the consummate skill and bravery of the contending admirals. During these operations, about 90,000 of the inhabitants of London were swept away by a plague; and in September 1666, a fire broke out, which, raging for three days, laid in ashes the greater part of the city! These tremendous visitations, the latter of which popular prejudice ascribed to the catholics, were the means of giving a check to the contest with Holland. A diminution of the resources granted by parliament, constrained the king to think of pacific measures. But De Wit, pensioner and governor of the Dutch republic, protracted the negociation, in the hope of humbling the English for their unprovoked and unjust aggressions; and taking advantage of the moment, he sent De Ruyter with a fleet, who sailed up the Thames, as far as Upnore castle, destroying the shipping in his passage, and then, not finding himself supported by the French as he expected, returned, spreading alarm along the coasts. England was at length relieved of this dangerous enemy, by a peace which was signed at Breda on the 10th of July 1667. To arrest the conquests of France, now begun in the Netherlands, a triple alliance, which soon after led to the treaty of Aix-la-Chapelle, was formed in 1668 between Holland, England, and Sweden.

In Scotland the presbyterians were still oppressed. The proceedings of the ecclesiastical commission were carried on with unabated rigour; and the consciences of the people were tried before the tribunal

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of arbitrary and unwarrantable power. Even the crafty and vindictive Lauderdale, who had superseded the ferocious Middleton, in the administration of Scottish affairs, advised the king to more lenient steps; but this abatement of tyranny came too late to allay the irritation which harsher conduct had produced. The covenanters, having taken up arms, were attacked and defeated near the Pentland hills, by general Dalziel. Scenes of barbarity ensued, sufficient to appal the stoutest feelings of the human mind; imprisonment, banishment, and death, accompanied with every refinement of cruelty, were the punishments to which the vanquished were doomed. A young preacher, Hugh M'Kail, after suffering the excruciating torture of the boot, expired on the scaffold, uttering these sublime and pathetic accents:—"Farewell, father and mother, friends and relations! farewell thou sun, moon, and stars! farewell, world and time! farewell, weak and frail body! Welcome eternity! welcome angels and saints! welcome Saviour of the world! and welcome God, the judge of all!" The violence of that persecuting spirit, for which Sharpe was distinguished subsequently to the affair at Pentland, had rendered him so odious to the public, that one day, while passing in his coach down the High Street of Edinburgh, an unsuccessful attempt was made upon his life. This vacillating and unprincipled bishop, as if acquainted with the secret designs of Charles for establishing popery in the nation, was of opinion that the presbyterians were more dangerous to his majesty's government than the catholics, who were at this time (1671) considerably increased, and that their meetings should be watched with a jealousy and a rigour which surpassed all former severity against them.

The king, in order to render himself independent of parliament, and to overturn the protestant religion, reposed all his confidence in Clifford, Ashley, Buckingham, Arlington, and Lauderdale; and from the five letters which begin their names, the junto, composed of these ministers, was called the *Cabal*. By the advice of this junto, he signed an agreement with Louis XIV. for destroying the Dutch republic; and it was farther stipulated that Charles should receive from France L.200,000 annually, and assistance in accomplishing his project in favour of the Roman faith. The Commons, deluded by the assurance that such supplies were necessary to maintain the triple alliance into which he had lately entered, voted him between L.200,000 and L.300,000; but having squandered this money by his thoughtless extravagance, and dreading the result of another application to parliament, who had already discovered his object, he seized the issues of the Exchequer, to the ruin of the commercial interest. James, duke of York, avowed his conversion to popery; a proclamation of indulgence to liberty of conscience was made; and on the 17th of March 1672, war was declared against Holland, on the most frivolous pretences. During this war several bloody but indecisive engagements took place by sea, although by land the combined powers were more successful. The terms offered to the Dutch, who earnestly sued for peace, were, from their threatening the very dissolution of the republic, too insulting to be accepted. To the popular fury now excited by despair, De Wit fell a sacrifice; and the administration of affairs devolved on the prince of Orange. With a view to bring him over to their interest, the allied sovereigns held out to him the most splendid offers. But he spurned the proffered boon with a noble disdain; and when Buckingham urged him by the destruction which a refusal would bring upon the commonwealth, he replied, in a high tone of patriotic feeling: "There is one certain means by which I can be sure never to see my country's ruin, I will die in the last ditch."

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The oppression of the Dutch protestants excited the murmurs of the British nation; and Charles, to justify his conduct, or to sound his subjects more fully in reference to the war, summoned a parliament in the beginning of 1673. Indignant at the dispensing power which he had assumed in matters of religion, they opposed his declaration of indulgence, and passed the *test act*, enjoining upon all who fill offices of trust to take the oath of allegiance and supremacy, to receive the sacrament as administered in the established church, and to abjure the popish doctrine of transubstantiation. After an adjournment, parliament again met in October, when they remonstrated against the marriage negociating between the duke of York and the catholic duchess of Modena; voted the standing army a grievance; and avowed their determination to grant no more supplies for maintaining hostilities with Holland. In order to avoid altercations, and to afford the duke time to conclude the match, they were dismissed; and when re-assembled in 1674, the king found their sentiments regarding the subjects of former discussion unaltered; and he signed a separate peace with the United Provinces, on terms advantageous to Britain.

During the four years immediately subsequent to this treaty, nothing of any importance occurred. This period was chiefly employed with attempts on the part of Charles to obtain money from France, and with fruitless endeavours to deceive his people by false promises and professions; and, on the part of the Commons, with addresses against the duke's marriage, already celebrated by proxy; against standing armies, and other national grievances. Wishing in vain to recover the popularity which he had lost, the king, in November 1667, gave in marriage the princess Mary, his brother's eldest daughter, to William, prince of Orange.

In 1678, the attention of the nation was arrested by the rumour of a popish plot. The pope, it was pretended, had, in consequence of the heresy of England, Scotland, and Ireland, assumed the sovereignty of these kingdoms, and had delegated his authority to the jesuits, who were to take possession of them, after having cut off, by an universal massacre, the prince and his protestant subjects. But although Titus Oates, and the other obscure and incredible reporters of this plot, could produce no proof of its existence, their depositions gained weight in parliament, and spread alarm throughout the island; and Charles was obliged to adopt, with apparent approbation, measures against a conspiracy which he did not believe. The duke of York became every day more odious; and the minds of the Commons were prepared for a revolt, when the king, in 1679, dissolved the parliament, which, including its various sessions, had continued seventeen years. A new one was soon after called, which evinced the same determined opposition to popery and arbitrary proceedings, as the former had done. The standing army and king's guards were declared illegal: the *habeas corpus* act, that great bulwark of the British subject against oppressive imprisonments, was passed; and a bill for excluding the duke of York from the throne, was carried by a majority of 79 in the house of Commons, but was resisted and lost in the house of Lords.

Informed of an indisposition of the king, James returned from Brussels, whither, from prudential motives suggested by his majesty, he had retired during these transactions; and jealous of the popularity which the duke of Monmouth, natural son of Charles, had acquired, he visited Scotland, with the secret, though not ostensible object of strengthening his interest in that kingdom. Here the presbyterians were meanwhile subjected to increasing severities. The bloody Lauderdale exerted all his power to suppress conventicles; and, on the refusal of the landholders in the western counties to give bonds, engaging them, under heavy penalties, to prevent the assembling and entertaining of preachers on their estates, he let loose among them 6000 lawless Highlanders, to threaten, and pillage, and destroy. About this time an instrument of infamous oppression, archbishop Sharpe, came to his end. He was dispatched on Magusmuir by a small party of presbyterians, while they way-laid one Carmichael, whom they also detested for his cruelty. The crime of perpetrating this nefarious deed was charged upon the whole body of covenanters, who were in consequence exposed to the most violent persecution. Driven to desperation, they again took up arms, and defeated Graham of Claverhouse, who attacked them on Loudonhill. With a force, augmented by thousands who now flocked to their standard, they immediately marched to Hamilton; and expelling the royal troops from Glasgow, made themselves masters of that town, where they issued a proclamation, declaring that they fought against the king's supremacy, and against all popish and prelatical impositions. The duke of Monmouth engaged the insurgents at Bothwell bridge, and, their ammunition failing, dispersed them with great loss, killing 700, and taking 1,200 prisoners. To these captives, whom the humanity of Monmouth preserved from massacre, pardon was offered on terms which few of them accepted; and to punish their obstinacy, 300 of them were shipped for Barbadoes, and unfortunately perished on the voyage. An act of indemnity was soon passed, which, through the barbarous artifice of Lauderdale, afforded them but little protection.

Having dissolved a parliament which was keen in its support of the popular interest, Charles was assailed with numerous addresses from his subjects, some clamorously praying for a new election, and others disapproving of these prayers, and expressing their respectful submission to the authority of the crown. Hence, the opposite parties were distinguished by the names of *Petitioners* and *Abhorrers;* to the former of whom was also applied, by way of reproach, the appellation of *Whigs,* and to the latter that of *Tories.* A parliament was at length summoned in October 1680, which was far from displaying an accommodating spirit. The Commons declaimed against the abhorrers, and continued committing them to prison, till one Stowel checked their arbitrary proceedings by his manly resistance. Mortified by a second rejection of the exclusion bill in the house of Lords, they resolved to withhold all supply whatever from the king, and to make those who should in future advance him money on any part of his revenue, responsible for their conduct. Charles, finding them invincible in their purpose, dismissed them by a dissolution.

With the view of humbling the inhabitants of London by a mark of neglect, and in the hope, perhaps, of managing the Commons when removed to a distance from a place where the spirit of faction prevailed, Charles summoned a parliament to meet at Oxford in 1681. Here, however, he was as unsuccessful as he had hitherto been, for they even surpassed their predecessors in the acrimony with which they urged the bill of exclusion, and refused listening to a proposal for banishing the duke of York 500 miles from England, and for leaving him, on the death of his majesty, with the bare title of king, while the next heir should be constituted regent with regal power. Availing himself of a debate, concerning one Fitzharris, an Irish catholic, who pretended to divulge the secret of another popish plot, Charles dissolved the last parliament he was determined ever to call. On this sudden and unforeseen measure, so confounding to the Commons, addresses and congratulations poured in to him from all quarters. Maxims the most favourable to monarchy pervaded the nation; and such was the quick transition from one extreme to another, that the people rushed into that very slavery, against which they had so long struggled.

The severity of the king's temper now appeared, in that despotic authority with which he guided the reins of government. Through the evil counsels of his brother, he spread terror over the island; and the privileges of his subjects were no longer free from the grasp of oppression. The city of London was deprived of its charter, which, in 1683, was restored on the humbling condition of conceding the right of nominating its magistrates to the crown. Alarmed at this violent infraction of liberty, the other corporations in England also delivered up their charters, and, before they could recover them, were obliged to pay large sums of money, and to submit to certain restrictions. Many conspiracies were now formed, detected, and punished; in some of which the duke of Monmouth, with several associates of rank and influence, was concerned. Although the general object of the conspirators was to oppose the succession of James to the throne, different views were entertained as to the subsequent settlement of the kingdom. Monmouth aspired to the sovereignty himself; Lord Russel and John Hampden wished a redress of grievances; and Lord Essex and Algernon Sidney contended for a republic.

In the mean-time, distresses in the north were unabated. The acts against conventicles were again put in force, and the duke of York, who succeeded

Lauderdale in the management of Scottish affairs, treated the presbyterians with a rigour and cruelty, revolting to every principle of humanity and justice. At his request, a test was passed for enjoining the king's supremacy; and because the earl of Argyle, who from his youth had been distinguished for his loyalty, took this test with an innocent explanation, he was condemned for high treason to suffer the forfeiture and punishment of a traitor. But before the execution of the sentence he escaped from prison, and fled to Holland. About this time, one Cameron, the leader of a religious party bearing his name, publicly excommunicated Charles for his breach of the covenant, but was soon after slain at Airs-moss, in an action with the royal troops. James having returned to London on a visit to the king, the administration devolved on the earl of Aberdeen and the duke of Queensberry,—two men whose characters were as despicable as their abilities were weak. Under them, upwards of 200 persons were outlawed, on pretence of holding intercourse with rebels; and every exertion was made to ensnare people living peaceably in their own houses, by extorting from them an avowal of their private sentiments. To them the following questions were put: "Will you renounce the covenant? Was the rising at Bothwell rebellion? Was the killing of archbishop Sharpe murder?" If they refused to answer these questions, they were exposed to torture, to banishment, and to death. Even women expired on the gibbet, or were drowned at the stake.

In order to increase his growing popularity, Charles, in 1684, gave in marriage his niece, lady Anne, to prince George of Denmark. Yet though he was daily rising in the public opinion, the violence of his brother's temper, and the severity of his administration, occasioned him great uneasiness; so that he deemed it expedient to meditate a new plan of government. Accordingly, he proposed to dismiss all the ministers obnoxious to the people, and even thought of calling a parliament, when he was suddenly attacked with a disease, resembling an apoplexy. After languishing a few days, he died on the 6th of February 1685, in the 59th year of his age, and, calculating from the time of his restoration, in the 25th year of his reign. During his illness, he shewed great indifference to the established clergy, and a strong predilection for catholic priests. From the hands of the latter he received the sacrament, and thus departed in communion with the church of Rome. In his character as a man, he had a lively wit and polite manners, associated with a criminal addiction to pleasures, and a total disregard of all religion; and as a sovereign, he was led astray by high ideas of prerogative, was lavish of the public treasures, and jealous of the liberty of his subjects.

James II.—Under the title of James II. the duke of York acceded to the crown, without opposition. Having summoned a privy council, he declared his intention to maintain the constitution in church and state; but his conduct soon evinced the insincerity of his professions. He went publicly to mass, dispatched one Caryl to Rome with expressions of his submission to the pope, and claimed, as a matter of right, all the customs and the greatest part of the excise, which had been granted during life to the late king. Finding it necessary to assemble a parliament, he renewed his promise to support the protestant religion, and requested and obtained the same settled revenue which his brother had enjoyed. In his speech, he observed, "There is indeed, one popular argument against complying with my demand. Men may think, that by feeding me from time to time with such supplies as they think convenient, they will better secure frequent meetings of parliament; but as this is the first time I speak to you from the throne, I must plainly tell you, that such an expedient will be highly improper to employ with me, and that the best way to engage me to meet you often, is always to use me well."

The Scottish parliament was equally compliant with the English; and the authority of James was absolute and undisputed, when Monmouth, who had retired to the continent, where he was still pursued by the vengeance of his uncle, made a descent upon England, with scarcely a hundred men. But such was the popularity of the duke, aided, doubtless, by the prevalent aversion to popery, that in four days, 2000 flocked to his standard, and, in a short time, the number increased to 6000. After being proclaimed at Bridgewater, Wells, and Frone, he was attacked by Feversham at Sedgemore; and chiefly through the cowardice of lord Grey, to whom he entrusted the command of his cavalry, he was overcome with great slaughter. Monmouth, flying from the field, until his horse sunk under him, was found in a ditch, concealed among ferns, with raw pease in his pocket. He wept on being seized; petitioned in the most submissive terms for his life; and even signed a paper, presented to him by the king, declaring his own illegitimacy. Yet the relentless tyrant refused to pardon him; and amidst the silent tears of the people, who attended him to the scaffold, he met his fate with the greatest fortitude. By the brutal severity of colonel Kirke and judge Jefferies, the most savage butcheries were committed on his adherents.

Returning from Holland, whither he had effected his escape under the former reign, the earl of Argyle seconded the views of Monmouth in Scotland. But his small army, amounting to 2,500 men, which he with difficulty raised, fell away on the appearance of the royal troops; and he himself was taken prisoner near Renfrew, while standing up to the neck in a pool of water. The earl was carried to Edinburgh, where, with a serene and manly spirit, he publicly suffered execution. Every possible outrage assailed those who favoured his rebellion, and his estates were made the scenes of devastation, of misery, and of death.

James, emboldened by the prosperity which at present attended him, began to speak and act as an absolute monarch. Hitherto he had covertly protected the catholics, while the parliament dared not to penetrate his designs, but now openly avowing their cause, in attempting to set aside the test, both houses, convinced of the danger which threatened the established church and the protestant religion, resisted his unwarrantable measures. They demanded, whether, in virtue of his prerogatives, he could dispense with the laws? a question which occupied the public mind, awakened the national hatred of popery, and called forth harangues from the pulpit, by no means calculated to allay the fears of the people. Irritated by this opposition, he first prorogued and then dissolved the parliament.

The revocation of the edict of Nantes by Louis XIV. in 1686, drove into England nearly 50,000 French protestants, who, as living monuments of oppression, spread the terrors of Romish superstition over the country. At this time, an arbitrary tribunal, resembling the commission court of Elizabeth, was established, which decided in favour of the king's dispensing power, and suspended Compton, bishop of London, for suffering a clergyman to preach with impunity against the church of Rome. Four catholic lords were admitted into the privy council; and James, influenced by the queen, and Father Peters, his confessor, displayed an indiscreet and precipitate zeal in making converts to his own opinions.

In 1687, the king issued a proclamation, offering liberty of conscience to all denominations of Christians under his government; and he tried in vain to facilitate an acquiesence in this edict, by laying a bait before the non-conformists. He next endeavoured to reconcile his dominions to the catholic see. With this view he dispatched the earl of Castlemaine, as his ambassador extraordinary to Rome; a step not less pleasing to his subjects, than to the Pope himself, who could by no means approve of the rashness and imprudence of a scheme, which was likely to terminate in the most fatal consequences. The ambassador, accordingly, was coolly received; and Innocent XI. deemed it sufficient merely to send his nuncio to London, to consecrate bishops, who should publish their pastoral instructions, with the permission of the king.

James now made an unsuccessful attempt to open the universities to catholics; and the means he employed for the accomplishment of this object had excited a ferment, when he issued a second declaration of indulgence, and ordered it to be read in all the churches, at the conclusion of divine service. But the clergy, considering this order as a violence done to their consciences, as well as a manifest infringement on the laws of the nation, six bishops drew up a remonstrance against it to the king, which being construed into a seditious libel, these venerable men were committed to the tower, to stand their trial. The jury pronounced them "not guilty," and Westminster hall, and the whole city, were filled with the loudest acclamations of joy.

Since the revolt of Monmouth, the royal troops had been encamped, during the summer, on Hounslow-heath. James, being present on the spot, was at dinner in Lord Feversham's tent, when his ears were suddenly assailed with shouts from without. On inquiring into the cause, he was told by Feversham, that "it was nothing but the soldiers rejoicing for the acquital of the bishops." His majesty replied, "Call you that nothing? but so much the worse for them." Although sensible, as he must have already been, that he stood alone with a small handful of catholics against the people, and even against his own army, he was too blind and infatuated to desist from his purpose. Judging this the proper crisis for breaking the silence, which he had hitherto observed, William, prince of Orange, avowed his determination to oppose the repealing of the penal statutes, without the consent of parliament,—a consent which he knew could not be obtained. Such an interference, while it encouraged the protestants to persevere in stemming the tide of popery, gave grievous offence to James, and furnished him with a pretext for meditating hostilities with the United Provinces. Numerous individuals leaving the country, offered their services to William, and requested his prompt and active exertions to save the nation from the ruin which threatened its civil and ecclesiastical constitution. Whigs and Tories, churchmen and dissenters, forgetting their mutual animosities, joined in this patriotic request; and the prince of Orange, having made every necessary provision and arrangement, waited a favourable opportunity of sailing for England. Through the medium of France, James was informed of the secret designs of his son-in-law; but he refused to credit the information, until it was too late,—until all the concessions, which he was now disposed to make, were of no avail.

During these transactions, the cause of popery was gaining ground in Scotland. The laws against papists were superseded by the privy council; the earl of Perth, a convert from protestantism, opened a chapel for the celebration of mass, at Holyrood-house; and the unprincipled among the bishops, who were ambitious of the royal favour, forsook the reformed church to embrace the catholic faith. Amidst this relapse and alienation from genuine Christianity, the presbyterians conducted themselves with a consistency and firmness, which called down the vengeance of government. The amiable Renwick and others were executed; and such was the general abhorrence of the Romish religion, that a correspondence was renewed and carried on with the prince of Orange, as the only means of obtaining a deliverance from the tyranny and superstition, under which they groaned.

William, no longer concealing his projected invasion, published a manifesto, in which, after detailing the abuses which had armed the people against the government of James, he declared his intention of passing with an army into England, to call a free parliament, and to provide for the security of the nation. He embarked at Helvoetsluys with a fleet of about 500 vessels, and a force of 14,000 men, and landed at Torbay on the 5th of November 1688. At first the malecontents, in whose remembrance the executions, which followed Monmouth's rebellion, were still recent, kept a strict neutrality; in so much, that the prince, despairing of success, thought of returning to Holland. But while thus deliberating, he was joined by several persons of distinction and influence; and ere long the whole country, including many officers and regiments of royal troops, flocked to his standard. Even Lord Churchhill, afterwards duke of Marlborough, who was indebted for all his fortune to the king's bounty, went over to William, carrying along with him, among others, the duke of Grafton and colonel Berkley. Prince George of Denmark, together with the princess Anne, to

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whom he was married, also espoused the same cause; and James, on hearing the news of their defection, exclaimed, in an agony of grief, "God help me, my own children have forsaken me!" In now attempting to leave the kingdom, he was arrested and brought back to Whitehall; and being permitted to retire to Rochester, he escaped from his confinement, and went to France, whither the queen, with the infant prince, had gone before him. Thus terminated the reign of a king, who, though respectable in domestic life, and frugal of the public money, disregarded the civil and religious constitution of the country, and evinced a blind and intolerable zeal for the catholic church.

William III.—In January 1689, a parliament, or rather a convention, was summoned. By this convention, after much debating, the throne was declared vacant, in consequence of the flight of the king; the royal prerogative was reduced to its just bounds; the privileges of the nation were determined; and the crown was given to William and Mary.

On the abdication of James, the people of Scotland, with a few exceptions, rose in arms against the old government; the episcopal clergy in the south-western districts were carried in mock procession through their parishes; the students of the university of Glasgow burned the effigy of the pope; and those of the university of Edinburgh, aided by apprentices and the more zealous citizens, rifled the chapel of Holyroodhouse, and committed the images and books to the flames. A convention, called on the 22d of March, made a tender of the Scottish crown to the prince and princess of Orange. Many of the forfeited honours and estates were restored; popery indignantly proscribed; and presbyterianism, with all its claims, re-established. The revolution, thus accomplished, forms an important era in the annals of the united kingdoms.

Against Louis XIV. long dreaded as the scourge of Europe, a powerful confederacy had, through the influence of William, been lately formed at Augsburg. To this confederacy Britain now acceded; but the French monarch, far from being dispirited by such a combination, was resolved to assist James in regaining the throne which he had abdicated. Being, accordingly, supplied with a fleet for the invasion of Ireland, where his authority was still acknowledged, the ex-king, with some French officers and about 1200 British subjects, landed on the island, to be joined by the earl of Tyrconnel with an army of nearly 40,000 men. He soon proceeded to besiege the town of Londonderry, the only place in the kingdom which refused him submission; but he was at length obliged to abandon the siege with precipitation and great loss. The cause of James was at the same time undertaken in Scotland, by viscount Dundee, who, having collected a considerable force, was met, at the pass of Killicrankie in Athol, by a body of William's troops, under the command of general Mackay. A desperate and bloody engagement ensued; and the fortune of the day, which first inclined to the side of the Highlanders, who made a dash upon their enemies sword in hand, ultimately decided in favour of the English.

In Ireland the two hostile armies came in sight of each other on the opposite banks of the Boyne. William now appeared at the head of his own men; and as he was examining the ground along the side of the river, a shot from one of the enemy's cannon grazed his shoulder, and killed several of his followers. At six o'clock, next morning, his troops crossed in three different places; a furious battle commenced; the Irish fled with precipitation, and the protestants gained a signal victory. James kept at a distance from the field; while William, taking an active part in the scene, contributed to the success and glory of the combat. The campaign of 1691 determined the fate of Ireland. Having sustained a complete defeat at Aughrim, the Irish retreated to Limerick, where, on their capitulating, hostilities ceased. By this capitulation, the catholics were allowed the same religious liberties, which they enjoyed under Charles II. and the dissatisfied were permitted to remove with all their effects to any country but that of Britain. Accordingly, 14,000 of the inflexible adherents of James went over into France.

Meanwhile, Scotland witnessed a barbarous and inhuman transaction. It was deemed necessary, for the total suppression of the disorders in the Highlands, to require of all the clans, which had risen in Argyle's rebellion, the oath of allegiance to William's government. Macdonald of Glencoe, the last that stood out, was prevented by a storm from taking this oath before the sheriff of Argyleshire, till the specified period had expired. But although the sheriff yielded to his entreaties, and accepted the oath, which he instantly transmitted to the privy council, the fact of Macdonald's submission was basely concealed; and being misrepresented by the earls of Stair and Braidalbin, captain Campbell of Glenlyon was employed to put them all to the sword. The consequence was, that after entertaining, for fifteen days, with great hospitality, Campbell and his men, who pretended to have come as friends, Macdonald and the unsuspecting inhabitants of the vale of Glencoe were doomed to destruction, in February 1691; neither youth, nor age, nor sex escaped, except by a timely flight to the mountains. William immediately instituted an enquiry into the cause of this shocking barbarity, and the guilt being traced to Stair and Braidalbin, the former was dismissed, and the latter suffered a temporary disgrace.

James, having completely failed in Ireland, now rested his hopes on the exertions of Louis; and the French king, projecting an invasion of England, appointed admiral Tourville, with 63 ships of the line, to favour the descent of James, with a considerable force under his command. But admiral Russel, being dispatched with 99 ships of the line to oppose this armament, the two fleets engaged off La Hogue on the 19th of May 1692, and, after an action of ten hours, the English were victorious. The French lost fifteen large vessels, together with the empire of the sea, which they had recently obtained. From this time to his death, a period of about seven years, James continued as a pensioner of Louis at St Germains. Respecting his unfortunate situation, Le Tellier, archbishop of Rheims, said with justice, though rather with levity—"There is a simpleton has given three kingdoms for a mass."

William had to contend with the house of Commons, and to submit to restraints on his authority. They examined into the uses to which he devoted the money they had given him; and, before they would vote him new supplies, they, in 1694, urged and obtained his consent to a bill, for limiting the duration of parliament to three years. This limitation was judged necessary for the preservation of liberty, and the preventing of corruption, because a longer continuance had rendered it an object to influence the elections by purchasing votes. In 1696, a conspiracy which had been formed against the king, was discovered; and on this occasion both houses evincing a zeal for his safety, entered into an association for the defence of his person, and the support of his government.

The war, on the continent, was at length terminated in 1697, by the treaty of Ryswick, in which France acknowledged William as the legitimate sovereign of Great Britain and Ireland, and promised to give him no more trouble, either directly or indirectly. To carry on this war, immense sums of money had been voted by parliament. But the nation was now tired of oppressive taxes; and when the king demanded a fresh subsidy for the discharge of debts, and the maintenance of the army, the Commons resolved, without a division, that none of the land forces, raised since September 1680, should be retained. This parliament was dissolved, and another called; and William having as yet made no military reductions, an act was passed, ordering all the troops in England and Wales, with the exception of 7,000, to be disbanded, by a fixed day. From his partiality to the Dutch, he had become rather unpopular; and it was the wish of the nation, that no foreigner, but George prince of Denmark, should be admitted into his councils.

A new parliament, called in 1700, was more compliant. They assured the king that they were ready to co-operate with him in the adoption of any measure, which had for its object the interest of the protestant religion, or the safety and advantage of the nation. And to prevent the restoration of the exiled family, they enacted that the crown, on the event of Anne's dying without issue, should devolve on Sophia of Hanover.

On the 16th of September, James died at St Germains, and Louis declared his son, the pretended prince of Wales, king of Great Britain, under the title of James III. Ere long, however, the French monarch saw reason to repent of a step, which excited the indignation of the English, without serving the prince. The present state of the public feelings offered to William a favourable opportunity, for obtaining supplies. He represented the conduct of Louis as an attempt which threatened the interest of the protestant religion, the tranquillity of the people, and the liberty of the nation; he exaggerated the power of the house of Bourbon, which after acceding, in terms of a late treaty, to the throne of Spain, would endeavour to establish a popish sovereign upon that of England; he held out, that commerce would be ruined by the union of the French and Spanish monarchies, unless some effectual measures were adopted, to humble them before they had time to combine their forces; in a word, he shewed that the conquests, to which America might fall an easy prey, would be sufficient to counterbalance the expences of the war.

Both houses of parliament entered cordially into his views; and, resolving that no peace should be concluded with France, until reparation was made for the insult she had offered, in declaring the pretended prince of Wales king of England, they granted a large supply, and ordained that 40,000 men should be raised, for hostile operations on the continent. The season for commencing the approaching campaign arrived, when William was taken dangerously ill. His constitution had been for some time declining, but a fracture of his collar-bone, occasioned by a fall from his horse while hunting, brought on a fever and diarrhœa, which ended his days on the 16th of March 1702, in the 14th year of his reign, and 52d of his age; having survived for a few years his amiable consort, who had been carried off by the small-pox.

In the reign of William, the system of borrowing money on remote funds was introduced; a standing army was for the first time sanctioned by parliament; and the bank of England, together with the salt and stamp offices, was established. His character has been differently represented, in being either darkened by prejudice, or heightened by partiality. Candour, however, must admit, that although a zealous presbyterian, he was a public-spirited monarch, a brave general, and an able statesman.

Anne.—On the death of William, Anne, the only surviving daughter of James II. ascended the throne of Britain, conformably to the order of succession established by parliament. Determined to follow up the intentions of her predecessor, she, with the approbation of the Commons, declared war against France. This declaration was seconded by a similar one on the part of Holland and Germany; and Louis, indignant at such a combination, could not help expressing his contempt of the United Provinces. "As for these gentlemen pedlars, the Dutch," said he, "they shall one day repent their insolence and presumption, in declaring war against one, whose power they had formerly felt and dreaded."

The famous duke of Marlborough, who enjoyed the confidence of Anne, was appointed generalissimo of the allied forces of England and Holland; and every preparation was made for the ensuing campaign. With a force of 60,000 men, he took the field in July, and obtained some considerable advantages in Flanders, over the French army, commanded by the duke of Burgundy and marshal de Boufflers. While the enemy retired before him, Spanish Guelderland was left exposed, and the towns of Werk, Venlo, Ruremonde, and Liege were obliged to surrender. During these transactions on land, achievements no less signal were accomplished by sea. The combined fleets of England and Holland attacked a French squadron, as they were sailing into the port of Vigo, with the Spanish galleons from the West Indies under their protection; and although the assailed were driven to the necessity of burning their vessels, ten ships of war, together with eleven galleons, richly laden with pieces of eight, were taken, through the skill and activity of the gallant admiral Sir George Rooke.

Marlborough, having received for his services the thanks of parliament, and a grant from the queen of L.5000 per annum, out of the post-office revenue, entered in 1703 on his second campaign, in which the French were rather the gainers. But the next year opened up a scene of the most splendid glory to the confederated arms. It was now the celebrated battle of Blenheim, on the banks of the Danube, was fought. The troops, under Marlborough and prince Eugene, which amounted to about 52,000 men, were opposed by a superior body of 60,000, commanded by the elector of Bavaria, and the marshals Tallard and Marsin. So dreadful was the carnage, that the field and the Danube were covered with the dead; and the engagement so disastrous to the French, reduced their army to about half their number. The allied troops under Marlborough, afterwards re-crossing the Rhine, made themselves masters of Landau, Treves, and Friesbach.

In the same year, 1704, after the prince of Hesse had made an unsuccessful attempt on Barcelona, Sir George Rooke, supported by a considerable force, took from the Spaniards the town and fort of Gibraltar. This place, of such consequence to the English, for the refitting of their vessels, and the protection of their trade in the Mediterranean, has continued ever since in their possession. But of so little value was it deemed at the time, that Sir George was left unrewarded for his useful services, and was even displaced from his command.

The duke of Marlborough, again taking the field in 1705, proposed penetrating into France by the way of Lorraine, when, at the request of the United Provinces, he abandoned his project, and joined the Dutch troops against marshal de Villeroi, who had marched with a formidable army to Liege. De Villeroi was defeated with considerable loss; but desirous, perhaps, of retrieving his reputation, he soon after came to an engagement at Ramilies, where, though the French occupied superior ground, the military genius of the invincible Marlborough led him in half an hour to a complete victory. The result was the conquest of Brabant, and of nearly the whole of Spanish Flanders.

While the French had some advantages in Italy, the allied troops had others in Spain. Philip V. grandson of Louis XIV. had ascended the throne of the latter kingdom, notwithstanding the treaty which had been formerly entered into, for conferring the crown on the archduke Charles, son of the emperor of Germany. The English and Dutch maintained the cause of the house of Austria, in opposition to that of the house of Bourbon. An armament, conducted by the earl of Peterborough and Sir Cloudesly Shovel, arrived on the Spanish coast, spreading alarm among the inhabitants; the fortresses of Lorida and Tortosa surrendered; Barcelona was obliged to capitulate; and the provinces of Valencia and Catalonia were reduced. Philip, on the approach of the hostile army, withdrew from the seat of government; and the archduke, whom the Spaniards and Portuguese contemptuously styled, "Charles, by the grace of heretics, catholic king," was proclaimed at Madrid. But the marshal de Berwick, natural son of James II. aided by the patriotic enthusiasm of bishops, priests, monks, peasants, and even women and children, soon recovered the capital, and brought back Philip amidst shouts and demonstrations of joy. In 1707 Berwick and the duke of Orleans reconquered the whole of Spain, with the exception of Catalonia.

In the meantime a negociation began, which terminated in an event of the utmost consequence to the independence, peace, and prosperity of Britain. Since the accession of James I. in 1603, the sceptres of England and Scotland had been swayed by one sovereign; but, though repeated attempts had been made, no coalition of the two legislatures had yet taken place. The accomplishment of this was left to add splendour to the reign of queen Anne. With the concurrence of both parliaments, she named commissioners from each to meet in the Cockpit at Whitehall, for considering and forwarding so desirable an object. The articles, drawn up and signed by these commissioners, were laid before the respective parliaments for their consent; and, after keen debates between the different parties, and after an amicable adjustment of the matters in dispute, a definitive arrangement was adopted, and the articles of the union were finally ratified in January 1707, when the Scottish parliament was for ever dissolved. In these articles it was stipulated, among other subjects of agreement, "That the succession to the united kingdoms should be invested in the house of Hanover; that all the subjects of Great Britain should enjoy a communication of privileges and advantages; that the laws concerning public right, policy, and civil government, should be the same throughout the nation; that the court of Session, and all other courts of judicature in Scotland, should remain as then constituted by the laws of that kingdom; that Scotland should be represented by sixteen peers and forty-five commoners; that all the peers of Scotland should be peers of Great Britain, and rank immediately after the English peers at the time of the union, and before such as should be created after it; and that they should enjoy all the privileges of English peers, except that of sitting and voting in parliament, or sitting upon the trials of peers."

About this time the French king, trusting to the co-operation of those whose minds were inflamed by their failure in opposing the union, threatened Britain with an invasion in favour of the Pretender, or, as he was called, the chevalier St George. The country became generally alarmed; the Whigs, who had begun to decline in power, combined their influence with that of the Tories in support of the common cause; the *habeas corpus* act was suspended; and the chevalier and his adherents were declared traitors and rebels. A French fleet appeared in the Frith of Forth, but being closely pursued by the English, under Sir George Rooke, it returned to Dunkirk, to the great mortification of the Pretender, who, with tears, expressed his anxiety to get on shore.

The duke of Marlborough still pushed the war on the continent, with his usual success; and while, in 1708, he defeated the French near Oudenarde, and took Lisle, the bulwark of the French frontier, major-general Stanhope, with not more than 300 men, re-

Civil history. duced the island of Minorca. Louis, who had lately offered terms of peace which were not accepted, again renewed his proposals to the Dutch, but they refused to listen to them without the concurrence of the allies, who, by making extravagant demands, to which France could not accede, protracted hostilities. Next year the famous battle of Malplaquet was gained by the confederate troops, after much skill and valour had been displayed on both sides. The campaign of 1710 and 1711, opened a free passage almost to Paris, and spread alarm among the inhabitants.

Meanwhile, the Tories, whom the duke of Marlborough had deserted, on finding the Whigs more ready to support his schemes of humbling France, had begun to plot his disgrace. Harley and Bolingbroke supplanted him in the favour of the queen, and employed every method which malice and revenge could suggest to exasperate the nation against him. The whig system, on which the greater part of this reign had been conducted, was completely overturned; Marlborough was dismissed from all his employments, and the command given to the duke of Ormond; and, after many negociations at Utrecht, peace was at length signed at that place by the belligerent powers, on the 31st of March 1713.

The duke of Marlborough retired to the continent, furnishing a striking instance of the evanescence of popularity and the instability of fortune. Although at one time the idol of the queen and the boast of parliament, he was now the object of their hatred and neglect. He was accused of insatiable avarice; his abilities were insulted; and even his courage was called in question. But since the military achievements at Cressy and Agincourt, a braver and more successful general had not appeared. In the course of ten campaigns, he never laid siege to a town, without taking it, nor engaged in a battle without gaining a victory. Nor was he less able in the cabinet than in the field.

On the 1st of August 1714, Anne died of an apoplexy, in the 50th year of her age, and the 13th of her reign; having survived her husband, prince George of Denmark, six years. She was adorned with all the virtues of her sex; and the epithet of the "Good Queen Anne" has been applied to her, expressive of the excellence of her character as a sovereign. With her ended the line of the Stuarts, who had been alike remarkable for their misconduct and their misfortunes, and who had swayed the sceptre of England 111, and that of Scotland 343 years.

George I.—Agreeably to the established order of succession, George, elector of Hanover, maternally descended from Elizabeth, daughter of James I. acceded to the throne. He came to England with strong prepossessions against the Tories, who, professing to believe in a divine hereditary right, favoured the claims of the Pretender; and he soon evinced an inclination to support the Whigs, to whom he was chiefly indebted for the crown. The great duke of Marlborough, returned from a voluntary exile, was again raised to honourable appointments; and in all the offices of trust under government, a total change was effected. In the new parliament, the Whigs, who had become by far the predominant party, treated with much severity the Tory, or Jacobite faction. Disorder and tumult were the consequences, to prevent which the *habeus corpus* act was suspended; and an edict, still in force, was passed, declaring it to be felony, without benefit of clergy, for persons unlawfully assembled to continue an hour together, after the proclamation should be publicly read. Civil history.

In 1715, many disaffected and Jacobite Scots rose in rebellion under the earl of Mar, who proclaimed the chevalier St George, and set up his standard in the Highlands. The rebel army, to the amount of 10,000 men, being furnished with arms, ammunition, and officers from France, made themselves masters of the whole county of Fife, and then marching towards Dumblane, they were met by the duke of Argyle, commander in chief of the forces in North Britain, whose troops were considerably fewer than half the number of the enemy. After a desperate engagement, in which both sides claimed the victory, the earl of Mar was quickly abandoned by the greater part of his irregular followers. The death of Louis XIV. on whose exertions the hopes of the Pretender principally rested, operated, doubtless, as a considerable disappointment, especially since the duke of Orleans, now intrusted with the regency of the kingdom, had entered into a strict alliance with his Britannic majesty. Yet the infatuated Chevalier embarked at Dunkirk, and landed at Peterhead, on the coast of Scotland, with only six gentlemen in his train. Proceeding to Feteresso, he was complimented by the earl of Mar and his other adherents; having received addresses from the clergy and laity of the episcopal communion in Aberdeenshire, he made his public entry into Dundee; and on the 7th of January 1716, he arrived at Scoon, where he assumed all the functions of royalty, and fixed the day of his coronation. His imaginary reign, however, was of short duration; for, pursued by the duke of Argyle, and destitute of every thing necessary for maintaining the war, he, accompanied by Mar, Drummond, and other persons of distinction, sailed back to the continent, in a vessel which lay in the harbour of Montrose.

During these transactions, the rebel arms in the north of England were attended with even less success. The earl of Derwentwater and Mr Foster proclaimed the Pretender at Morpeth and Alnwick, made a fruitless attempt on Newcastle, and, on receiving re-inforcements from the Scottish borders, took Preston without opposition. Here, being assailed by the royal troops under general Wills, they were obliged to surrender on the terms of unconditional submission to the mercy of the king.

The rebellion being thus suppressed, the laws were put in force against the deluded insurgents. Of the ringleaders, who were impeached and condemned to die, none suffered but the earls of Derwentwater and Kenmuir. An act, considered a daring infringement on the ancient constitution of the kingdom, was passed, for trying the private prisoners in London, and not at the place where the offence was committed. While some of them effected their escape, four or five were hanged, drawn, and quartered at Tyburn; twenty were executed at Manchester and Preston; and about one thousand, on petitioning the royal clemency, were transported to North America. On pretence of giving stability to government, a bill, at his time introduced, for extending the continuance of parliament to seven years, was carried in both houses by a great majority. Thus, one innovation followed another, and, although the people might murmur, it was impossible to obtain redress.

Incensed at the king of England for purchasing Bremen and Verden from the Danes, Charles XII. of Sweden threatened Britain with an invasion,—a threatening which would have probably been accomplished had it not been prevented by the fall of his Swedish majesty at the siege of Fredrickshall, in Norway. Meanwhile, with a view to secure his German dominions, George paid a visit to Hanover, and, among the several alliances into which he entered, that termed the *quadruple alliance*, contracted between him, the emperor, the States-general, and the king of France, is the most remarkable. This alliance laid the foundation of a quarrel with Spain. In 1718, Sir George Byng, sent with 22 ships of the line to the Mediterranean, engaged, near Syracuse, in Sicily, the Spanish fleet, consisting of 27 sail, and took the whole squadron, excepting three vessels, which the conduct of their vice-admiral Cammock, a native of Ireland, preserved. War was immediately proclaimed; and the Spaniards, determined to retaliate by supporting the claims of the Pretender, dispatched a powerful armament towards Britain, which was entirely dispersed by a storm off Cape Finisterre. Two frigates, however, conveyed the earls Marischal and Seaforth, and the marquis of Tullibardine, with 300 Spanish soldiers, to Scotland, where they were joined by 1600 Highlanders; but, being attacked by the regular troops under general Wightman, they were soon defeated, leaving to the rebel leaders, as their only resource, an escape to the continent. The failure of this expedition, in conjunction with the bad success of the Spanish arms in other quarters, constrained his catholic majesty to accede to the quadruple alliance.

In 1720, the Irish parliament was deprived of the right of final jurisdiction, and was rendered dependent on that of England; and in the same year the South Sea Company obtained an act to increase their capital, by redeeming the public debts. The greater part of the nation became stock-jobbers, and the stock, which had risen to L.1000 *per cent.* suddenly fell as low as L.150, to the ruin of many families. Vengeance was taken on the directors, who had enriched themselves by their fraudulent transactions; they were removed from their seats in parliament, and declared incapable of holding any office of trust in future; a bill was passed for confiscating their estates, and every thing, within the power of government, was done to alleviate the distress of the sufferers.

The king having received from the duke of Orleans intelligence of a plot, acquainted the new parliament, which met in 1722, with the designs of his enemies in favour of the Pretender. Enraged by this information, the Commons resolved that the sum of L.100,000 should be raised on the real and personal estates of papists, to aid in defraying the expences occasioned by the late disorders, and all the Scots of that communion were ordered, without delay, to register their names and their estates. Of the individuals concerned in this treasonable conspiracy, Christopher Layer, a young templar, was convicted, condemned, and executed; and Francis Atterbury, bishop of Rochester, on the mere evidence of hearsay and conjecture, was sent into perpetual banishment, where he soon after died.

In consequence of an alliance, recently contracted between the courts of Madrid and Vienna, it was contended in parliament, that the object of this coalition was to place the Pretender on the throne of Britain, and to wrest Gibraltar and Port Mahon from the English. These confederated powers denied, indeed, that any such object existed; but it was nevertheless deemed expedient to put the naval and military force of the kingdom on a respectable footing, and to enter into a counter-convention with France, Sweden, Denmark, and Prussia. To intercept the Spanish galleons from America, a squadron under admiral Hosier was dispatched to the West Indies, without success. The Spaniards, who in return invested Gibraltar, were equally unfortunate; after lying before it for some months, they were obliged to raise the siege, with the loss of 10,000 men. Preparations were every where making for war, when the mediation of the French king put a temporary stop to the farther effusion of blood.

On the third of June 1727, George having appointed an administration in his absence, set out for his electoral dominions, and in four days arrived at the town of Voet in Holland. He reached Delden on the ninth; and next morning, while prosecuting his journey, a stroke of the palsy rendered it necessary to carry him to Osnaburgh, where he expired on the 11th, in the 68th year of his age, and the 13th of his reign. In his person he was about the middle size; in his features he was regular and manly; and in his deportment he was grave and majestic. He was an able general, a consummate politician, and a mild and engaging prince; and if he ever departed from the principles of the British constitution, the fault was ascribable not to himself, but to the suggestions of a venal ministry, to whom the interior government of the kingdom was almost entirely committed.

During the interval between the death of Charles II. and of George I., Britain rose to high eminence in every department of literature and science. Among the divines may be mentioned Tillotson, Patrick, Cumberland, Clarke, Pearson, Beveridge, and Bentley. Among the philosophers, Newton, Boyle, Halley, Flamstead, Keil, Hay, Locke, Cudworth, and Berkley. Among the physicians, Friend, Mead, Sydenham, and Pitcairne. Among the political writers, Davenant, Swift, Addison, Bolingbroke, and Trenchard. And among the poets, Congreve, Prior, Rowe, Pope, Parnel, and Gay.

George II.—As soon as an express arrived with the news of the king's death, his son, George II. ascended the throne. He adopted the political system established by his father, continued Sir Robert Walpole at the head of the treasury, and avowed his intention to preserve the constitution in church and state. On his accession, the two parties, which divided the kingdom, were denominated the *court* and *country* factions. His first speech to parliament announced his sincere resolution to merit the love of

Civil history. his people; and numbers who were dissatisfied under the former reign, expressed their attachment to his person and government. The civil list was fixed at L.800,000; and the disputes about the increase of the national debt, which now amounted to L.52,000,000, terminated in favour of the ministry.

The congress which opened at Soissons in 1728, proved ineffectual for allaying the contentions of Europe, and the Spaniards committed, with impunity, depredations on the commerce of Britain. Petitions from the merchants of London, Liverpool, and Bristol, complaining of these depredations, were presented to parliament, and the Commons, in addresses to the king, prayed him to use every effort to check such daring aggressions. A peace was soon after concluded with Spain, by the treaty of Seville. In 1733, Sir Robert Walpole proposed levying a partial excise on tobacco; a proposal, which, from the dread of such an impost extending to other articles, was violently resisted by the country party. The ferment it produced throughout the nation constrained the minister to drop his scheme, even with a majority of 61 of the Commons in its favour. Emboldened with this success, the opposition members endeavoured to obtain a repeal of septennial parliaments; but, mortified at losing their object, they left the house, and retired to their seats in the country.

Although, by the treaty of Seville, all differences between Spain and Britain seemed to be adjusted, the Spaniards sought occasion for a rupture, by distressing the commerce of the British, and disputing their right to cut log-wood in the bay of Campeachy. Their vessels were boarded and plundered by the captains of the *guarda costas*, one of whom cut off the ear of a captain Jenkins, and desired him to carry it to the king, with the assurance that the Spaniards would serve him in a similar manner, should an opportunity occur. It is not to be wondered at that these insulting and predaceous practices were complained of, and that the voice of the nation was loud for war. Between the two crowns, however, a convention was concluded, in which it was stipulated that Spain should, by certain payments, indemnify the subjects of Britain for the injuries they had sustained. The terms of this convention were soon violated, and hostilities commenced in 1739.

To prosecute a war so congenial to the wishes of the people, supplies were readily granted; and admiral Vernon, being dispatched with only six ships to the coast of South America, destroyed the fortifications of Porto Bello, almost without opposition, and almost without loss. About this time, commodore Anson was sent to annoy the Spaniards in the South sea. But detained beyond the proper season, through the mismanagement of the ministry, his vessels were dispersed by a storm. Having touched at the island of Juan Fernandez, where he was joined by one ship and a frigate, he sailed along the coast of Chili, and plundered and burned the town of Paita. In traversing the great Pacific ocean, he refreshed his men at the island of Tinian; and his hopes were at length gratified by the capture of a Spanish galleon from the Philippine islands, a prize valued at no less than L.313,000. Another armament with which Anson was destined occasionally to co-operate across the isthmus of Darien, made an unsuccessful attempt on Carthagena. Civil history.

The failure of this enterprize, together with other unfortunate naval operations, incensed the nation against Sir Robert Walpole. By the new elections in 1741, the country party gained the ascendency in the house of Commons, and Walpole, seeing his influence at an end, resigned all his employments. The succeeding administration, by following the steps of their predecessors, became equally unpopular; and a continental war was now determined on to retrieve the honours which Britain had lost.

On the death of the emperor of Germany, his daughter, the queen of Hungary, was, in terms of the *Pragmatic treaty*, heir to his dominions. But France, regardless of this treaty, set up the duke of Bavaria as her rival; and while Prussia deprived her of Silesia, the rest of her territories were attacked by France, Saxony, and Bavaria. In this extremity, Britain, from generous motives, or it may be with the view of balancing the different interests of the empire, stepped forward to the assistance of the young queen. A body of British troops, strengthened by 16,000 Hanoverians, drove the French from Bohemia; while her own general, prince Charles of Lorraine, stripped the duke of Bavaria of all his hereditary possessions. The British and Hanoverians, trying to form a junction with the prince, gave rise to the battle of Dettingen, which was glorious to the confederated arms.

To make the English relax in their exertions on the continent, the French threatened Britain with an invasion in favour of the Pretender. An armament of 20 ships of the line, and 15,000 troops, was preparing for embarkation at Dunkirk, when Sir John Norris, with a superior fleet, prevented the execution of the design. Between the two kingdoms war was now openly declared. In the Netherlands, the campaign of 1744 was adverse to the allies, who, with a force of about 70,000 men, including British, Dutch, Hanoverians, and Austrians, engaged at Fontenoy a French army amounting to 120,000. The former was defeated, but the losses on both sides, though immense, were nearly equal. To atone for this disaster, the honour of the British flag was retrieved by admirals Rowley and Warren; and the important fortress of Louisburgh in North America, was taken by general Pepperel.

Charles Edward, son of the Pretender, was resolved to make an effort to gain the British throne; and being furnished by France with about L.4,000, seven officers, and arms for 2,100 men, he landed with a frigate on the coast of Lochaber in Scotland, in 1745, accompanied by the marquis of Tullibardine, Sir John Macdonald, Sir Thomas Sheridan, and other adventurers. Marching southward with 1500 Highlanders, he caused his father to be proclaimed at Perth; and his force still increasing as he advanced, he entered Edinburgh without opposition, where the rite of proclamation was again performed. In the meantime Sir John Cope, appointed by government to check his progress, arrived at Dunbar, with his army, from Aberdeen; Charles drew out his troops to meet him; and in an engagement on Tranent-moor, near Prestonpans, the impetuosity of the rebels, in a few minutes, led them to a complete victory.

After remaining some time at Edinburgh, in the empty enjoyment of the title and honours of royalty, the young Pretender, joined by the earl of Kilmarnock, the lords Elcho, Balmerino, Ogilvy, and Pitsligo, and the eldest son of lord Lovat, invaded England, where the duke of Cumberland and general Wade were preparing to oppose him. Having taken the town and castle of Carlisle, he passed through Penrith, Lancaster, Preston, and Manchester, to Derby, little more than 100 miles from London; and then, finding himself disappointed in his expected succours from France, he effected a safe retreat into Scotland, though closely pursued by the king's troops. He proceeded to Glasgow, and from thence to Stirling; and receiving some additions to the number of his followers, he invested the castle. General Hawley left Edinburgh with a considerable force to raise the siege; and the two armies came to a battle at Falkirk; the rebels drove the enemy before them with precipitation, and enriched themselves with the tents and artillery whch fell into their hands.

But the triumphs of Charles were at an end. The duke of Cumberland, with 14,000 men, took the field; the insurgents retired before him towards Aberdeen; and the disastrous action at Culloden, in 1746, decided the fate of the adventurer. Scenes of awful severity followed; the conquerors consigned the whole country around to slaughter, plunder, and desolation. The young Pretender was now reduced to the most distressing situation. A reward of L.30,000 was offered for his head; and to elude the vigilance of his enemies, he sought shelter in the dreary solitude of caves, mountains, and forests. One day, fatigued with wandering, and pressed with hunger, he ventured into the house of a person attached to the opposite cause: "The son of your king," said he, on entering, "comes to beg a bit of bread, and clothes. I know your present attachment to my adversaries, but I believe you have sufficient honour not to abuse my confidence, or to take the advantage of my misfortunes. Take these rags, that have for some time been my only covering, and keep them. You may, probably, restore them to me one day, when seated on the throne of the kings of Great Britain." He succeeded according to his wishes; and after lurking about six months amidst the wilds of Glengary, and trusting his life to the fidelity of fifty individuals, he, at last, with Cameron of Lochiel and other fugitives, embarked in a privateer of St Malo, and escaped to France.

Meanwhile those insurgents, who had fallen into the hands of the victors, were doomed to the most dreadful vengeance. Seventeen officers were hanged, drawn, and quartered, on Kennington-common near London; six were executed at Brompton; eleven at York; seven at Penrith, and nine at Carlisle. The earl of Kilmarnock, and the lords Balmerino and Lovat, were beheaded on Towerhill; and many of the common men were transported to America.

On the suppression of the rebellion, plans were adopted by government for the civilization and improvement of the Highlands. In 1747, heritable jurisdictions were abolished, and the power of the chieftains over their enthralled vassals dissolved. The inhabitants were compelled, under severe penalties, to lay aside their ancient garb for that of their lowland neighbours; but this act was afterwards mitigated by the wise administration of the immortal Chatham. Savage ferocity began to give way to the arts of peace; barren heaths and uncultivated deserts to become fruitful fields; and every thing in those mountainous and neglected regions, to assume a new aspect.

The flame of war still raged on the continent. At Roucroux and La Feldt the allies were defeated; the strongest fortification of Dutch Brabant, Bergen-op-zoom, was taken; and an unsuccessful attempt was made by the English on Port L'Orient. But these advantages on the part of France were counterbalanced by her losses in other quarters. Her army met with reverses in Italy; and her naval and commercial enterprizes were rendered abortive by the active energies of the admirals Anson, Warren, and Hawke. The French king was now desirous of peace; and a treaty, the basis of which was a general restitution of conquests, was, in 1748, concluded at Aix-la-Chapelle, where the earl of Sandwich and Sir Thomas Robinson acted as the plenipotentiaries of Britain.

The only remarkable events which took place during the following short interval of peace were, the colonization of Nova Scotia; the death of the amiable and beloved Frederick, prince of Wales; the alteration of the style, according to the Gregorian calender, by merging the eleven days, between the 3d and 14th of September 1752; and the establishment of the Society for the Encouragement of Arts, Manufactures, and Commerce.

In the treaty of Aix-la-Chapelle, the respective boundaries of the French and British in North America had not been accurately defined; and the disputes arising upon this subject, together with the encroachments of the former power, led in 1755 to an open declaration of war. Admiral Boscawen was dispatched with a squadron to the banks of Newfoundland, where he captured two French ships of war; and orders being issued for seizing, and bringing into British ports, all French vessels, whether outward or homeward bound, a considerable number of them, together with about 30,000 sailors, were soon in the possession of the English. General Braddock, sent out to Virginia to command the forces destined to act against the French on the Ohio, was defeated and slain in the midst of a pathless swamp, not far from Fort du Quesne. But an advantage was afterwards gained over them and the Indians by general Johnson on the lake Ontario; and colonel Monckton drove the enemy from their encroachments on the province of Nova Scotia.

The French, after threatening an invasion of Britain, which never took place, landed in 1756 an army of 11,000 men in Minorca, and invested Fort St Philip. Admiral Byng was ordered out with a squadron of ten ships of the line to raise the siege; but by a partial, if not cowardly engagement with the French fleet under admiral Gallissoniere, he suffered them to escape, and general Blakeney, the governor, was reduced to the necessity of surrendering the place. The voice of the nation was loud against the conduct of Byng, who was, in consequence, brought to public justice, and sentenced to be shot. But the loss of Fort St Philip was more than compensated by the successes of our privateers in Europe and America, and by the splendid achievements of colonel Clive in the East Indies,—achievements which have contributed to the extent and the riches of our Asiatic possessions.

Mr Pitt, being about this time introduced into the administration, adopted a new system of operations against France. An expedition was fitted out for carrying the arms of Britain into that country; it sailed on the 8th of September 1757, and returned without even attempting the object for which it was planned, farther than the reduction of the small island of Aix. Yet, though general Mordaunt, who had the command of the land forces, was acquitted on trial, such was the confidence of the people in the minister, that no murmurings whatever were expressed. The French now attacked the electorate of Hanover, and compelled the duke of Cumberland, at the head of 50,000 confederates, to sign a disgraceful capitulation at Closter Seven; but in the following year, his Britannic majesty having entered into a treaty of mutual defence with the king of Prussia, the Hanoverians, under the Prussian general, prince Ferdinand of Brunswick, drove the enemy from their dominions. On the death of the duke of Marlborough, who had been sent over with 12,000 men to co-operate with prince Ferdinand, the command of the British troops devolved on Lord George Sackville; and, had it not been for a misunderstanding between these two generals, the battle of Minden, so glorious in the annals of military history, would have been more decisive.

The British were equally fortunate in other parts of the globe. In North America, Louisburg, which had been restored to the French by the treaty of Aix-la-Chapelle, was reduced in 1758 by general Amherst; and if general Abercromby failed in his attempt on Crown Point, brigadier-general Forbes succeeded on Fort du Quesne. Admiral Pocock, on the coast of Asiatic India, defeated the French fleet near Fort St George, and a second time near Pondicherry; and the colonels Laurence and Draper obliged the enemy to retire with precipitation from the siege of Madras. In 1759 the African island Goree was taken by commodore Keppel; Guadaloupe surrendered to admiral More and general Hopson; and Quebec, after an obstinate action, in which the gallant Wolfe fell, submitted to general Townsend. In short, the British completed the conquest of the whole of the French empire in North America.

France having again threatened an invasion of Britain, desisted from the attempt, on the defeat of their fleets by Admirals Hawke and Boscawen. The war in Germany continued still undecisive; and the French king, wearied with fruitless operations, made proposals of peace. In the meantime George II. died suddenly at Kensington in the 77th year of his age and the 33d of his reign. His character possessed many excellent qualities; he was humane in his disposition, steady in his attachments, liberal in his religious principles, and equitable in his government. Yet his predilection for his native country was rather conspicuous. Under his reign commerce flourished, and the arts and the sciences made considerable progress.

George III. A. D. 1760.—No prince ascended the throne of England under more favourable circumstances than those which signalized the accession of this sovereign. The propriety of his behaviour, his moderation in avoiding public affairs where his interference could not prove salutary, and the ease and agreeableness of his manners, bespoke general regard. An able and active ministry carried on war with success, and enjoyed popularity at home. The prejudicial affection for the Stuart family, which had so long and so frequently divided or distracted the kingdom, had either entirely ceased to exist, or merely lingered in some romantic minds, as a tribute of compassionate feeling to the remembrance of fallen greatness; and the commercial prosperity of the country, promoted and secured by a multiplicity of manufactures, and a vastly extended navigation, more than kept pace with the large expenditure which her foreign relations demanded. The patriotic and sensible speech which his majesty addressed to parliament, sanctioned and enhanced the pleasing prospect naturally rising from such considerations, and at once, in the most ardent terms, identified the predilections, the sentiments, and the wishes of the monarch, with the happiness and interests of his subjects. Yet, in the judgment of the discerning few who had access to explore the secret springs which were either to realise or to thwart the hopes of the nation, there was not wanting a very sufficient reason for distrust and apprehension, in the influence of the Earl of Bute over his august pupil. Their fears were not long without the confirmation of facts; but even in the partial and tardy manner by which a change in administration was effected, insidious and timid as it might be deemed, there appeared some not unamiable anxiety to reconcile, as much as possible, certain royal prepossessions with the opinions and attachments of the people. Magnanimity of character, indeed, would have gloried in an opportunity of sacrificing personalities at the shrine of public good; but self-denial is too rare among princes to justify discontent when it is not remarkably displayed. The patriotic Mr Legge, who had been unfortunate enough, though with honour, to give offence to the king, when prince of Wales, was dismissed from the office of chancellor of the Exchequer the very day on which parliament was dissolved, and Sir Francis Dashwood, a zealous *Tory*, chosen in his place. At the same time, Lord Holdernesse made a *politic* and *premeditated* resignation of the seals, which were instantly given to the Earl of Bute, who appointed Mr Charles Jenkinson, afterwards Lord Liverpool, his under secretary.

Mr Pitt resigns.—Notwithstanding this change, which plainly indicated the feelings of the monarch, Mr Pitt for a time retained the management of foreign affairs, and prosecuted the war with no inconsiderable success. But he was by no means so buoyed up by any advantages on the part of the allies, or the surrender of Belleisle, and some fortunate operations in the East and West Indies, as to disregard a negociation for peace formerly proposed by France, and now resumed. Sundry advances were favourably received, and a termination of hostilities seemed their natural issue, when the invidious interference of Spain, now intent on the family compact, induced him somewhat indignantly to abandon the conference, and to urge immediate war against that kingdom. But in this advice, to which he was prompted by intelligence of an alliance between the courts of Madrid and Paris, in his imagination highly inimical to Great Britain, he was supported only by earl Temple, his brother-in-law, at that time lord Privy-seal. On this proof of his diminished influence in the cabinet, he thought proper to resign, that, to use his own words, he might not "remain responsible for measures which he was no longer allowed to guide." Such conduct appeared to partake more of obstinacy than true wisdom to the reflecting part of the nation, who could not but approve a wish to avoid a new war in the burdened state of the finances, and who could not perceive that a friendly alliance between those two powers should necessarily contain any articles prejudicial to the welfare of the kingdom. But the public voice, which he had so long and so justly merited, declared in favour of Mr Pitt's determination, whilst the ministry, to which the earl of Egremont acceded in his place, by an equivocal and irresolute behaviour, lost an opportunity of vindicating the correctness of their own views, and, in reality, gave occasion for a semblance of truth to his prophetic anticipations. After some foolish manifestations of pride and false honour, in a negociation between the British and Spanish governments, the two countries found themselves committed in a war, in opposition, apparently, both to their wishes and their interests. The ex-minister, of course, obtained credit for almost more than human sagacity; and the subsequent success of the contest was with equal justice ascribed to the remains of his vigorous spirit, which still shed its influence on the public counsels. His Majesty, on the 8th September 1761, married the Princess Charlotte Sophia of Mecklenburgh Strelitz. Their coronation was celebrated on the 22d of the same month.

Lord Bute retires.—The war with Spain in conjunction with France, which was declared on the 4th January 1762, continued till the 10th February in the following year, when a definitive treaty was concluded at Paris. The terms, which were communicated to parliament in its previous meeting, were not such as the country, proud of its conquests, and vaunting its superiority, expected, and drew forth the indignation and violent censure of Mr Pitt, as "obscuring all the glories of the war, surrendering the dearest interests of the nation, and sacrificing public faith, by an abandonment of its allies." But such sentiments, blazoned as they were by the vehement eloquence of that distinguished character, and eagerly adopted by a people always intent on brilliant warfare, cannot be applauded by the impartial historian, who, at the distance of half a century, can calmly contemplate the real merits of the whole transaction. He will, in fact, have little difficulty in yielding this peace his almost unqualified approbation, and the preference to any practical prosecution of hostilities. But neither the sanction of parliament, nor the benefits likely to accrue from the termination of a war, which had, at all events, required no ordinary pecuniary sacrifices, could screen the new minister, commonly denominated the *Favourite*, now possessed of a power and influence which no individual had enjoyed since the days of Lord Clarendon, from popular dislike, and the effective and widespread energies of the opposition, at present composed of some of the ablest and most distinguished persons in the country, and openly countenanced by the duke of Cumberland, uncle to the king. Lord Bute, whose courage was not equal to his ambition or his pride, beheld the difficulties thickening around him with no small solicitude, and at last, apparently making a merit of necessity, resolved on retiring "to the blessings of the life he loved," rather than await the issue of an embittered and dangerous contention. This very unexpected resignation gave comparatively little satisfaction, because it was imagined a mere artifice to avoid responsibility, whilst his real agency was prolonged in a manner more repugnant to the constitution and well-being of the kingdom.

John Wilkes and the North Briton.—Mr George Grenville succeeded the earl of Bute as First Commissioner of the Treasury; on the death of Lord Egremont the seals were given to the earl of Sandwich; and the duke of Bedford, on his return from Paris, where he had negociated the treaty, was appointed President of the Council in the room of earl Granville, a nobleman who, for many years, and to the close of his life, had occupied that office with the highest respectability. A general coalition of parties was attempted at this period, but without effect, owing, in great degree, to the pertinacity or political honesty of Mr Pitt, who insisted on terms which the king conceived derogatory to royal dignity. The new ministry, therefore, ventured on their own strength to encounter their opponents; and party-spirit raged with more keenness than ever. Among the publications which embodied the virulence and zeal of the popular combatants, a work, edited by the famous John Wilkes, member of parliament for Aylesbury, under the name of The North Briton, gave most annoyance, by its indecent personalities and coarse invectives. Its periodical abuse was tolerated till the appearance of the 45th number, which seemed a studied experiment how far the liberty or rather licentiousness of the press could be carried with impunity to the author. A general warrant was issued for his apprehension. He was lodged in the Tower; his papers were seized, and all access to him was strictly forbidden. In a few days he was brought up to Westminster-hall on a writ of *habeas corpus*, and released by lord chief-justice Pratt, afterwards lord Camden, in consideration of his parliamentary privilege, which, in the opinion of that able and constitutional judge, could only be forfeited by treason, felony, or breach of the peace, whereas Mr Wilkes stood chargeable merely with writing a libel. A prosecution was immediately commenced against him by the attorney-general, to which he refused to answer. In consequence, a message from the king, communicating the whole transaction, was made to parliament, which, after a hot debate, by a large majority, declared the paper in question to be "a false, scandalous, and seditious libel," and ordered it to be burnt by the common hangman. Thus, injudiciously, was an immense degree of importance and eclat given to a production, which, by its own merits, would speedily and irremediably have sunk into oblivion. But the notoriety of its author did not rest here. A variety of proceedings established him more and more as the idol of the people; and it must be confessed, that, notwithstanding his numerous, gross, and unpardonable vices, his heroism and enterprise accomplished essential service to the political liberty of his country.

Project for taxing America.—The minister, on the termination of this at first trivial, but, in its bearings and consequences, momentous affair, hazarded an experiment still more ominous and interesting,—the relief of the financial burdens of the kingdom by a direct tax on its transatlantic provinces. This measure had long before been proposed to Sir Robert Walpole, but rejected by him as highly inexpedient and dangerous. It was reserved for the bustling and narrow-visioned intellect of Mr George Grenville, impressed with a complacent opinion of his all-sufficient dexterity, to venture on a project at once flattering to the pride, and, to appearance, friendly to the necessities of Britain, but which issued in the complete and final loss of her most valuable appendage. There was, however, some display of moderation in his manner of putting it into execution. His resolution to impose certain *stamp-duties* on the American colonies and plantations, for the purpose of levying a revenue payable into the British exchequer, was introduced into parliament in March 1764, but the practical conclusion from it was not decreed till the following year. It gave rise to an animated debate, but was carried through the house by a triumphant majority, and received the royal assent. In vain had memorials and petitions from the colonies poured in from the time that this famous bill was introduced, conveying opinions and urging suggestions against its principle, its justice, and its generosity,—in vain was it contended, that where representation was not awarded, or was impracticable, there taxations could not be inflicted without a manifestation of tyranny quite alien to the British constitution,—in vain did the manly general Conway, with a firm though solitary voice, protest against the *right* thus assumed by the legislature,—or colonel Barré, one of the most eminent speakers in the house, vindicate the freedom, the gratitude, and the loyalty of the Americans, but at the same time predict the fatal efficiency of their jealous love of liberty, so obnoxiously wounded by this alarming measure. The magic power of numbers on which the minister could securely calculate, presented a salvo for every fear, and an indemnity for every presumption. Thus, then, went out this memorable decree to its unhallowed work, a monument of British folly that might be for ever deplored, if the general welfare of mankind were not to be preferred to merely national dignity, and if the history of its operation did not furnish a salutary warning against implicit reliance on the *expressed wisdom* of parliament.

Marquis of Rockingham's ministry.—The victory thus gained by the minister did not secure his power, which was shortly afterwards broken up in a very unexpected manner. Some alarm having been occasioned by the indisposition of the king, it was judged expedient to make provision for a minority, in the event of any of his children being called to the throne in early life. In the arrangements for a regency to answer this purpose, the name of the Princess Dowager of Wales was omitted on the part of the ministry, but afterwards inserted by the Commons, on the motion of one of Lord Bute's friends. The princess took umbrage at such an injurious exclusion, and the court immediately formed a resolution hostile to the offenders. Overtures were accordingly made to Mr Pitt and Lord Temple, through the duke of Cumberland, but were not satisfactorily terminated. A second application to the same individuals was no less unhappy, owing to the inflexible demand of these patriotic statesmen, that there should be a total change of men and measures, to which the court was as inflexibly disinclined. On these failures, as his Majesty was at all events resolved on getting rid of his present ministers, a negociation was opened with the duke of Newcastle and his friends, and accomplished on more courteous terms. The party which thus came into power was that branch of Whigs, afterwards known by the name of *Rockingham*, from the marquis who was now placed at the head of the treasury. Among his colleagues, were the duke of Grafton, lord Winchelsea, general Conway, and Mr Dowdeswell. The combination was altogether highly respectable, and some of its members were no less eminent for talents than virtue. Yet did they encounter the censure and condemnation of Mr Pitt and Lord Temple, as having, by their accepting office, lost a fit opportunity for putting an end to the secret influence of the favourite, which was held so injurious to the country. Their administration which was of short continuance, effected an important concession to America, and other liberal measures. The repeal of the stamp act, particularly, would have been sufficient to merit encomium, though it somewhat mortified the pride of the nation. But it gave offence in a quarter where resentment was never allowed to remain long inoperative.

Ministry and resignation of Lord Chatham.—Mr Pitt, again applied to, formed a ministry, not altogether new, but to the exclusion of Lord Temple, who separated from him in no small displeasure. Being advanced to the peerage by the title of earl Chatham, he choose the office of lord Privy-seal. The duke of Grafton was appointed first lord of the Treasury. The earl of Shelburne succeeded the duke of Richmond, as one of the secretaries of state, general Conway remaining as he was. The Right Hon. Charles Townshend was made chancellor of the Exchequer, and lord chief-justice Pratt, now Lord Camden, accepted the office of lord Chancellor. Mr Pitt little consulted his reputation by his conduct at this period, and in reality lost the confidence and esteem of the people. Nor did the conduct of this ministry, from which, on Lord North succeeding to Mr Townshend, he found it necessary to withdraw, do justice to his principles, and sagacity as its former. It renewed the plan of taxing the colonies, though in a way, as was foolishly imagined, not likely to incur the same objection. In the midst of the discontents and murmurings which it occasioned in the new world, a war broke out in India with Hyder Ally; and the reappearance of Mr Wilkes on the political stage, besides giving rise to some popular disturbances, involved the parliament and the electors of Middlesex in an awkward contest about his eligibility for the honours of a representative.

Lord North's administration.—Lord Camden having sided with Lord Chatham's opposition in the discussion of Mr Wilkes's case, was deprived of the great seal, which fell into the hands of Mr Justice Bathurst, but not till Mr Yorke, who had pledged himself to listen to no offers of the court, put a period to his existence in a fit of remorse at having accepted it. Sundry resignations now took place, and latterly that of the duke of Grafton, who was succeeded by Lord North. Thus at last was organized an administration, which, for twelve successive years, in spite of an enlightened opposition, and the plainest dictates of experience, pursued a ruinous policy, and accumulated misfortunes, disappointments, and a host of taxes on the kingdom.

Extraordinary exertions of Lord Chatham.—The energies of Lord Chatham, for a while depressed by ill health, and a variety of vexations public and personal, unexpectedly broke forth again in 1770, the year in which this ministry was established. Several opportunities were presented for their display. The house of Lords having resolved itself into a committee on the state of the nation, Lord Rockingham moved, in allusion to the case of Mr Wilkes "That the house of Commons, in the exercise of its judicial authority in matters of election, is bound to judge according to the law of the land, and the known and established law and custom of parliament, which is part thereof." This proposition, which is similar to one moved in the lower house by Mr Dowdeswell, but got rid of by the dexterity of the minister, was intended to form part of certain resolutions, implying the condemnation, and leading to the reversal of a vote in the previous session. It was supported with his wonted ability by Lord Chatham, who stigmatized the conduct of the house of Commons in the harshest terms, and denominated its vote in favour of colonel Luttrell, as representative for Middlesex, though he had not a fourth part of the voices of the electors, "a gross invasion of the rights of election, a dangerous violation of the English constitution, and a corrupt sacrifice of their own honour." In order to gratify *individual resentment*, said he, "the laws had been despised, trampled upon, destroyed;—those laws which had been made by the stern virtue of their ancestors, the *iron barons* of old,—to whose virtue and whose blood,—to whose spirit in the hour of contest, and to whose fortitude in the triumph of victory, the *silken barons* of this day owe their honours and their security." This motion having been lost, and a very different one proposed, implying, that any resolution of the Peers, impeaching the judgment of the other house, was a violation of the rights of the Commons, his lordship rose again, and endeavoured to prove the necessity of interference in certain cases, of which the present was one. He conjured the Peers, by the noble blood which flowed in their veins for so many ages, and by the glorious struggles of their ancestors in the cause of freedom, not to behold such an alarming transaction with indifference. "But if," said he, "my lords, the constitution must be wounded, let it not receive its mortal stab at this dark and midnight hour, when almost every eye is closed in sleep, and when robbers and assassins only are awake, and prowling for their prey." The question, however, was decided in the affirmative.

Lord Mayor replies to the King.—Nor were his subsequent exertions in the same cause at all more successful, except in so far as they restored to him a portion, at least, of his former consequence in popular esteem. A candid inquirer into the particulars of this famous controversy, which in reality engaged for some time almost all the attention of the nation, can no more approve of the whole of his lordship's opinions and reasonings, than he can be satisfied with either the ministerial conduct or the popular enthusiasm on this subject. No very inadequate idea of the spirit which existed at this period will be conveyed, by stating a novel and highly hazardous circumstance in the presentation of one of the city's addresses to the king. His majesty had declared, that the contents of a former address and *remonstrance* from the city were "disrespectful to himself, injurious to parliament, and irreconcileable to the principles of the constitution." The city, in a new address, lamented the heavy displeasure which they had incurred, but nevertheless adhered to their former sentiments, and prayed for a dissolution of the parliament. To this his majesty answered, "that he should have been wanting to the public, as well as to himself, had he not expressed his dissatisfaction at their late address; and that he should ill deserve to be considered as the father of his people, could he suffer himself to be prevailed upon to make such an use of his prerogative as was inconsistent with the interest, and dangerous to the constitution of the kingdom." The lord mayor, Beckford, who presented the address, on this reply, demanded leave to answer the king, which, in the state of confusion produced by so unusual a request, was granted. He delivered himself in a spirited manner, and concluded his extemporary speech in the following terms: "Permit me, Sire, farther to observe, that whoever has already dared, or should hereafter endeavour, by false insinuations and suggestions, to alienate your majesty's affections from your loyal subjects in general, and from the city of London in particular, is an enemy to your majesty's person and family, a violator of the public peace, and a betrayer of our happy constitution, as it was established at the glorious and necessary revolution!" The effect of these observations was *obviously* unpleasant; but his majesty very prudently made no reply.

Altercation with Spain.—The public attention at this period was considerably diverted from domestic concerns by an aggression on the part of Spain, which, if the spirit of the people had been alone considered, would have led to a war with that kingdom. But the ministry, not without some appearance of sacrificing national honour, allowed an explanation on the insulting attack which had been made on the Falkland islands, and actually consented, in a secret article, to evacuate them at a certain term; by which means hostilities were prevented. The comparatively trivial value of that possession, could scarcely, indeed, have justified an appeal to the sword; but it is no less certain, that the respective conditions of the two countries would have safely borne out Great Britain in insisting on a more ample concession than was obtained. It was the unfortunate failing of the present ministry, to reserve its spirit and its obstinacy for those who were entitled to the most lenient consideration and indulgence.

Various domestic concerns.—In 1771, some changes of administration took place, in consequence of the death of the earl of Halifax, to whom the earl of Suffolk succeeded as secretary of state for the northern department. The duke of Grafton accepted the office of Privy-seal. This year was distinguished by an accession to the liberty of the press, of material importance to the nation,—the privilege, at first assumed, but afterwards virtually sanctioned, of publishing the debates in parliament without disguise or the employment of initials for the names of the speakers. In the following year, a bill for the enlargement of the toleration act intended to favour the dissenters was carried through the Commons, but lost in the house of Lords; as was also another bill for relief to the clergy from subscription to the thirty-nine articles. But, in consequence of the marriage of the dukes of Cumberland and Gloucester to persons beneath their own rank, an act was passed, prohibiting the descendants of George II. within certain limits, from marrying without the royal consent. Early in this year died the princess-dowager of Wales, in the 53d year of her age, whose influence over the mind of the king, and consequently the concerns of the nation, was too great not to warrant the notice of its termination. The state of India received very marked discussion at this period, and a bill for regulating its government, which passed through parliament, obtained the very general approbation of the people, though experience unfortunately did not demonstrate its beneficial efficacy.

Lord Clive accused.—Among the proceedings of a select committee appointed to enquire into the affairs of that country, the conduct of Lord Clive did not escape notice. Their report brought several very serious charges against him, which necessarily demanded investigation. Colonel Barré signalized himself in the debate. Remarking on an explanation of certain transactions of Lord Clive, he ironically observed, "that the fortunes amassed by the Company's servants were, *no doubt*, all honourably acquired. If the property of the natives was taken without their consent, it was *military plunder*; if otherwise, it was *compensation for services*; if by a commercial monopoly, it was *inland trade*." "The nice and ingenious distinctions made by the noble lord, between bribes and presents, exactions and gratuities, reminded him of a certain Spanish governor of Gibraltar, who, amongst other perquisites of office, had been accustomed to receive an annual donation from the Jews. This people having, on one of their anniversaries, brought him only a thousand sequins, were informed that they should not be favoured with an audience, 'as they were sprung from those who crucified Christ.' They went home disconcerted, but after farther consideration, returned with double the sum, on which they were admitted; 'for, said the governor, poor men! they had no hand in the crucifixion!" Lord Clive defended himself with great ability. A clause in a motion conveying censure on him was rejected, though voted for by the minister; and an amendment in his favour was carried by a respectable majority, which terminated the inquiry. But this success did not relieve Lord Clive from public odium. Nor did his subsequent melancholy and wretchedness, terminated as it was by a self-inflicted death, appear to belie the opinion which had been entertained of his character.

Lord Chatham's testimony in behalf of sectaries.—The bill for enlarging the toleration act being again introduced during the parliament of 1773, was lost, as before, in the Upper House. In the debate on the subject, some virulent remarks of the archbishop of York, who denominated the dissenting clergy "men of close ambition," drew forth the indignant and liberal spirit of Chatham. "The dissenting ministers, said he, are represented as men of *close ambition*,—they are so, my lords, and their ambition is to keep close to the college of fishermen, not of cardinals,—and to the doctrine of inspired apostles, not to the decrees of interested and aspiring bishops. *They* contend for a spiritual creed and spiritual worship. *We* have a Calvinistic creed, a popish liturgy, and an Arminian clergy. The reformation has laid open the scriptures to all,—let not the bishops shut them again. Laws in support of ecclesiastical power are pleaded for, which it would shock humanity to execute. It is said that religious sects have done great mischief when they were not kept under restraint; but history affords no proof that sects have ever been mischievous, when they were not oppressed and persecuted by the ruling church." For several succeeding years the administration of Lord North presents few interesting events, with the exception of what concerned the dispute with the American colonies, to which, therefore, it will be proper to direct attention.

Retrospect of American dispute.—The act of 1767, imposing certain port-duties on the colonies, contained a clause, empowering the crown to establish a civil list in every province, which gave no less offence than the taxes themselves. It was followed by the appointment of an American board of commissioners to be fixed at Boston, which no less plainly and obnoxiously indicated the determination to tax America. These measures were met with a state of discontent, bordering on rebellion, and an agreement among the merchants not to import any goods from the mother country, till redress should be given. Hitherto, without much inquiry, a discretionary legislative power had been pretty generally admitted to reside in the British parliament; but in course of time, and more particularly since the discovery of its object, and the manner in which this power was exercised, the colonists began to argue against the right to legislate for them, as well as to tax them without their consent. Henceforward, then, there was a new and a daily strengthening spirit to be encountered, which the ministry and politicians of Britain do not appear to have previously contemplated as a possible existence. A prejudice, amounting to infatuation, had precluded attention to the progress of political knowledge and the gradual acquisition of separate interests. Its influence was manifested in the instructions transmitted by his Majesty's secretary for foreign affairs, to governor Bernard, requiring the house of representatives to rescind a resolution of the assembly of Massachusett's, which had given birth to a circular letter, recommending the different provinces to enter into joint measures for the redress of their common grievances, and commanding the immediate dissolution of the assembly in case of refusal. But the spirit of opposition was no less displayed in the reply made to this extraordinary and arbitrary requisition: "If the votes of the house are to be controuled by the directions of a minister, we have left us but a vain semblance of liberty. We have now only to inform you (the governor), that this house have voted not to rescind." "Let Britain, said a member of the assembly, rescind her measures, or she will lose America for ever." The dissolution was ordered next day. This altercation attended and followed by various resolute demonstrations, happened in 1768,—an early, explicit, and unequivocal enunciation of the proposition which was afterwards discussed with such terrific arguments. In the midst of the proceedings to which it immediately gave rise, a tumult occurred at Boston, very characteristic of the popular feelings on the subject, and rendered more remarkable by the threatening parade of military force, drawn out to overawe the inhabitants. Such was the disturbance, coupled as it was with various symptoms of a refractory disposition, which occasioned the revival of an obsolete statute in the British legislature, for bringing over persons accused of treason committed beyond seas, to be tried in England, and which induced his Majesty to assure his parliament, "that he would not fail, in the mode they had recommended, to give the most effectual orders for bringing the authors of the disorders, &c. to condign punishment." But the communication of this retributive intention did not intimidate the colonists, nor did the dissolution of their respective assemblies by the governors interrupt their associations to obtain redress. Among other causes of complaint, the statute now alluded to was held peculiarly obnoxious, and highly derogatory to the rights of British subjects." That it was unnecessary there could be no doubt, because, by the local laws and constitutions of the colonies, there was ample provision made for the trial and punishment of delinquents; and that it was easily and extensively liable to abuse could be no less obvious. "How truly deplorable," said the representatives of Virginia in their address to the king, "how truly deplorable must be the case of a wretched American, who, having incurred the displeasure of any one in power, is dragged from his native home, conveyed to a distant land, where no friend will alleviate his distresses, and where no witness can be found to testify his innocence!" The irritation extensively propagated throughout America, was little allayed by the concessions of 1769, or rather indeed was augmented; because, in repealing all the taxes, with the exception of that on tea, there seemed to be an artful design to establish a pernicious principle and a precedent, in a manner which should leave only a shadow of reason to the objectors, and therefore excite more odium against them. This finesse, accordingly, utterly failed; and one opinion spread universally, that nothing short of a total repeal of all the revenue acts, and the injurious statutes of the present reign, could secure the union of Great Britain and her colonies. A sullenness and discontent, which were chiefly manifested on various occasions in the assembly of Massachusetts, continued till 1773, and too certainly, like the deep-seated annunciations of an earthquake. portended some explosion. The acquisition of some confidential letters, written by the governor and his friends, which fell into the hands of Dr Franklin, agent of the representatives in England, and which he transmitted to his constituents, proved the existence of a design to pursue *coercive measures* against the colonists, and of course gave a stimulus to their resentment. Their petition for the removal of the governor was ignominiously rejected; and Dr Franklin, who presented it, received the grossest abuse from Mr Wedderburne, afterwards lord Loughborough, at that time counsel for the defendants. In the same year the duty on tea was removed, at the urgent solicitation of the East India company, who felt severely the want of the American market, and who offered, in compensation, to pay double the sum on the export of that article. But they were egregiously disappointed in the result of this appeal. The colonists at once perceived that the principle of taxation was still kept up, though they were not in the first instance subjected to its operation. They unanimously resolved, therefore, that it should not take effect; and in reality so far succeeded, that in no place was the delivery of the tea allowed to be made. A more violent proceeding occurred at Boston, where the mob boarded the vessels in which it had been conveyed, and threw it into the sea.

Views of opposition as to America.—Such extraordinary obstinacy was no way softened down in the message of the king to the parliament of 1774, or in the concurrent representation of the minister, the effect of which was to produce the very general opinion that vigorous measures were absolutely necessary. The opposition made but feeble resistance to the proposal for retaliation or chastisement, but objected strongly to some of the modes by which it was to be carried into execution. "By this bill," said Colonel Barré, alluding to an act similar to one formerly mentioned, providing for the transmission of a certain class of offenders to Great Britain, "by this bill you are offering the last of human outrages to the people in America, by subjecting them, in effect, to military execution: instead of sending them the olive-branch, you have sent the naked sword. What madness is it that prompts you to attempt obtaining that by force, which may be with so much more facility and certainty procured by requisition?

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Retract your odious exertions of authority, and remember that the first step towards making them contribute to your wants, is to reconcile them to your government." A speech of Lord Chatham, on occasion of a bill subsequently introduced, contained the essence of his sentiments on this momentous dispute. "I condemn in the severest manner the turbulent and unwarrantable conduct of the Americans in some instances, particularly in the late riots at Boston; but, my lords, the mode which has been pursued to bring them back to a sense of their duty, is so diametrically opposite to every principle of sound policy, as to excite my utmost astonishment. You have involved the guilty and the innocent in one common punishment, and avenge the crime of a few lawless depredators upon the whole body of the inhabitants. My lords, the different provinces of America, in the excess of their gratitude for the repeal of the stamp act, seemed to vie with each other in expressions of loyalty and duty; but the moment they perceived that your intention to tax them was renewed, under a pretence of serving the East India company, their resentment got the ascendant of their moderation, and hurried them into actions which their cooler reason would abhor. But, my lords, from the whole complexion of the late proceedings, I cannot but incline to think, that administration has purposely irritated them into these violent acts, in order to gratify their own malice and revenge. What else could induce them to dress taxation, the father of American sedition, in the robes of an East India director, but to break in upon that mutual peace and harmony which then so happily subsisted between the colonies and the mother-country? My lords, it has always been my fixed and unalterable opinion, and I will carry it with me to the grave, that this country had no right under heaven to tax America. It is contrary to all the principles of justice and civil policy: it is contrary to that essential, unalterable right in nature, ingrafted into the British constitution as a fundamental law, that what a man has honestly acquired is absolutely his own, which he may freely give, but which cannot be taken from him without his consent. Pass then, my lords, instead of these harsh and severe edicts, an amnesty over their errors; by measures of lenity and affection allure them to their duty; act the part of a generous and forgiving parent. A period may arrive when this parent may stand in need of every assistance she can receive from a grateful and affectionate offspring."

First Congress's proceedings.—The effect of the recent measures of the British legislature, when communicated to America, was precisely what the observations and reasonings thus enforced, pointed out as likely to be realized. One undivided spirit of indignation and resentment sprung up among the colonists with electric celerity and force. A general congress of deputies from all the states, in spite of a proclamation by general Gage, declaring such a combination unlawful, hostile, and traitorous, was held at Philadelphia, on the 4th September 1774. It professed to feel deeply the sufferings of their countrymen in Massachusetts, under the unjust, cruel, and oppressive measures of the British parliament,—approved of the wisdom and fortitude which they had displayed in their resistance,—trusted that the united energies of America would carry conviction to the British people, of the unwise, unjust, and ruinous policy of the present administration,—agreed to support their countrymen in their laudable opposition,—published a declaration of rights for which they determined to contend;—but resolving, in the first instance, to pursue pacific measures, prepared an address to the people of Great Britain, and a loyal and humble petition to his majesty. These two documents are extraordinary productions, and deserve very marked consideration. Towards the close of the former they give a serious warning: "We think ourselves bound in duty to observe to you, that the schemes agitated against these colonies have been so conducted, as to render it prudent that you should extend your views to the most unhappy events, and be in all respects prepared for every contingency." After deprecating, in the latter, his Majesty's displeasure at the *language of freemen*, they say, "Your royal indignation, we hope, will rather fall on those designing and dangerous men, who, daringly interposing themselves between your royal person and your faithful subjects, have at length compelled us, by the force of accumulated injuries, to disturb your majesty's repose by our complaints."—"We ask but for peace, liberty, and safety. We wish not a diminution of the prerogative, nor do we solicit the grant of any new right in our favour. In the magnanimity and justice of your majesty and parliament, we confide for a redress of our grievances, trusting, that when the causes of our apprehensions are removed, our future conduct will prove us not unworthy of the regard we have been accustomed in our happier days to enjoy. And appealing to that Being who searches thoroughly the hearts of his creatures, we solemnly profess that our counsels have been influenced by no other motive than a dread of impending destruction. We implore, therefore, your majesty, as the loving father of all your people, connected by the same bands of law, loyalty, faith, and blood, not to suffer the transcendent relation formed by these ties to be farther violated, in uncertain expectation of effects, which, if attained, never can compensate for the calamities through which they must be gained." The resolutions of this first congress were universally confirmed by the provincial assemblies; and thus, the rudiments of an independent state may be said to have been completely organized.

Americans slighted by the ministry.—But the eloquence, the complaints, and all the other demonstrations of united feeling on the part of the Americans, were utterly lost on the infatuated ministry, or rather aggravated and fostered their proud purpose, to enforce obedience, and never to relent in the demands of British supremacy. Nay, they were even guilty of the superlative inconsistency, or most culpable affectation, of practically disparaging the resources and the courage of the colonists, whilst the whole of their proceedings, and the unvaried tenor of their language, were calculated to put every possible desire, and every potential means of resistance into full requisition. Thus they reduced a fifth part of the number of seamen voted last year, and the first lord of the

Admiralty had the folly to assert, that the Americans "were neither disciplined nor capable of discipline; and that, formed of such materials, and so indisposed to encounter danger, their numbers would only add to the facility of their defeat." Lord Chatham again endeavoured, though in a very infirm state of health, to arrest the impending calamity. He reprobated more pointedly than ever the conduct of administration, and advised, as essential to the slightest hope of reconciliation, the removal of the British army from the scene of contest: "America," said his lordship, "cannot be reconciled,—she ought not to be reconciled to this country, till the troops of Britain are withdrawn from the continent; they are a bar to all confidence,—they are a source of perpetual irritation,—they threaten a fatal catastrophe. How can America trust you, with the bayonet at her breast? How can she suppose that you mean less than bondage and death?—The recal of your army I urge as necessarily preparatory to the restoration of your peace. By this it will appear, that you are disposed to treat amicably and equitably, and to consider, revise, and repeal, if it should be found necessary, as I affirm it will, those violent acts and declarations which have disseminated confusion throughout the empire. Resistance to these acts was necessary, and therefore just; and your vain declarations of the omnipotence of parliament, and your imperious doctrines of the necessity of submission, will be found equally impotent to convince or enslave America, who feels that tyranny is equally intolerable, whether it be exercised by an individual part of the legislature, or by the collective bodies which compose it. The means of enforcing this thraldom are found to be as ridiculous and weak in practice, as they are unjust in principle." His lordship's bill for settling the troubles in America was rejected by a majority of 61 to 32 voices, on a motion of Lord Gower, president of the council, that it should not be suffered to lie on the table. His lordship, highly resenting this indignity, entered on his own vindication, and inveighed against his opponents in the most cutting manner. "By the indecent attempt now made to stifle this bill *in embryo*, ministers might hope that the contents of it would sink into silence and oblivion. But, though rejected here, it would, he trusted, ever remain a monument of his earnest, however ineffectual, endeavours to serve his country. It would, at least, manifest how zealous he had been to avert the impending storm, which seemed ready to burst over us, and overwhelm the empire in ruin. He acknowledged himself, however, on cool reflection, not indeed much surprised, that men who hate liberty should also hate those that prize it; that those who want virtue themselves, should persecute them who possess it. Since the first entrance of the present ministers into office, the whole of their political conduct had been one continued series of weakness, temerity, ignorance, despotism and corruption. In one view only did they appear sound statesmen and able politicians,—in a strict and unwearied attention to their own interests. Such were their characters, and such their abilities, that no plan of government could be expected to succeed in their hands; and they themselves, he doubted not, were fully conscious that the adoption of any system of conciliation, founded on a wise and rational policy, would annihilate their power, and reduce them to that state of insignificance for which God and nature had designed them."

Americans declared in rebellion.—On the following day, Lord North, in the house of Commons, moved an address to the king, declaring America in a state of rebellion, and assuring his majesty, "that it is their fixed resolution, at the hazard of their lives and fortunes, to support his majesty against all rebellious attempts, in the maintenance of his just rights, and those of the two houses of parliament." This gave rise to a vehement debate, and in some degree startled the more moderate adherents of the ministry. An amendment, proposed by Mr Charles Fox, who had a little before been rather rudely dismissed from the treasury bench for his refractoriness, "deploring that the information which the papers laid before them had afforded, served only to convince the house that the measures taken by his majesty's servants tended rather to widen than to heal the unhappy differences between Great Britain and America, and praying an alteration in the same," was rejected by a majority of 304 to 105 voices. A conciliatory proposition, afterwards very unexpectedly advanced by Lord North, alarmed the high prerogative party, but was in reality quite nugatory, as it implied the right of taxation, to which, it was well known, the Americans were insuperably opposed. Mr Burke, who may be considered as the representative of the Rockingham party, also proposed a series of conciliatory resolutions, of a much more judicious and effectual nature,—but they were negatived in a very triumphant manner; and every other attempt to accomplish the same desirable object proved equally unsuccessful. The session closed without a single act which could conduce to the restoration of tranquillity in the now universally disaffected provinces, but to the perfect satisfaction of his majesty, who declared from the throne "his entire conviction that the most salutary effects must result from such measures, formed and conducted on such principles." Never was opinion more erroneously formed, or hope more egregiously disappointed.

Progress of hostilities.—In a smart but desultory engagement at Lexington, where the first blood was shed, the loss of the British was nearly 300 men, whilst that of the colonists did not exceed 90,—a very ominous commencement of this most impolitic war. The congress unanimously rejected Lord North's conciliatory plan, as had been anticipated, and paid no attention to a conditional offer of an amnesty on the part of general Gage. They chose Mr Hancock president of their assembly, and gave the command of their army to George Washington. An attack on the American entrenchments at Bunker's-hill, to the north of Boston, under general Howe, succeeded in its object, but cost the British upwards of 1000 men, including more than 80 officers,—a loss, it was remarked, nearly equal to that at the battle of Minden, where the British infantry had to sustain the fire of the whole French army. Though encouraged by their success in this early stage of the contest, the congress again petitioned the king for peace, but were informed, through their agent, Mr Penn, that

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no answer would be given! The Canadians, applied to by the British, declined taking part in the quarrel. They were afterwards invaded by the colonists under general Montgomery, but without success. In 1776, the duke of Grafton, who had seceded from the ministry, made another conciliatory motion, which was as ineffectual as any that had preceded it. Treaties were now entered into with some of the German princes for the hire of troops to serve against the colonists,—a measure severely, but vainly, reproached by the opposition. But even this compact was commendable in comparison of the employment, in the same cause, of the savage tribes inhabiting the frontiers and neighbourhood of the revolted provinces. This year was remarkable for various military operations, in which, though often and signally unfortunate, the Americans acquired military habits and skill, and saw good reason for the confidence which they had placed in their own fortitude, and the varied abilities of their general. But the chief event was the unanimous declaration of independence on the part of the delegates from the thirteen colonies, solemnly promulgated on the 4th July. This important act was most indignantly stigmatized in his majesty's speech, as presumption, rebellion, treason,—words which were very differently construed by the parties now at issue. On the rejection of a motion by lord John Cavendish, those members of opposition attached to the Rockingham principles, absented themselves from parliament, on the allegation, that all discussion of ministerial measures was utterly useless.

Progress of hostilities in 1777.—The probability or certainty that the French would avail themselves of the contest between Great Britain and the colonies, besides his former opinions, which every day's experience confirmed, determined Lord Chatham once more to labour at the work of reconciliation. His speech, on moving an address to his majesty to take the most speedy and effectual measures for putting a stop to the present unnatural war, contained some remarkable passages. "We have tried, said he, for unconditional submission,—let us now try what can be gained by unconditional redress. The door of mercy has been hitherto shut against them; you have ransacked every corner of Germany for boors and ruffians to invade and ravage their country;—for to conquer it, my lords, is impossible,—you cannot do it. I may as well pretend to drive them before me with *this crutch!*" "America, my lords, is now contending with Great Britain under a masked battery of France, which will open as she perceives this country to be sufficiently weakened by the contest, and finds herself sufficiently prepared. France will not lose so fair an opportunity of separating, for ever, America from this kingdom. This is the critical moment,—for such a treaty must and will take place should pacification be delayed: and war between England and France is not the less probable because professions of amity continue to be made." "If it be asked, why should we submit to concede? I will tell you, my lords. Because you have been the aggressors from the beginning; you ought, therefore, to make the first overture. I say again, my lords, you have been the aggressors. You have made descents upon their coasts, you have burnt their towns, plundered their country, made war upon their inhabitants, confiscated their property, proscribed and imprisoned their persons; you have injured, oppressed, and endeavoured to enslave them. America is therefore entitled to redress." The motion was lost by a large majority: and the session closed in June with a speech from his majesty, filled with exuberant compliments to parliament on the evidences which they had afforded of their discernment of the true interests of their country! In the early part of the campaign, Washington prudently avoided a general battle. He hazarded one at the passage of the river Brandywine, where his loss amounted to about 1300 men, after which he retired towards Philadelphia, but could not hinder general Howe entering that city in triumph. He ventured another engagement at Germantown, but was obliged to retreat. In the whole of these operations, it was more and more evident, that the Americans were improving in the military character, and hence the probability of overcoming them progressively diminished. Their success was vastly greater in the north, where general Burgoyne, who had just arrived from England to supersede general Carleton, after obtaining sundry advantages, found himself at last necessitated to capitulate to the American army under general Gates. The tidings of this most disastrous event, when communicated to parliament early in December, produced very general surprise and mortification. Lord North, affected to tears, acknowledged he had been unfortunate, but vindicated his intentions. The opposition, of course, were not wanting in censure and sarcasm; and, from this period, fairly enough calculated on a diminution of ministerial strength. Lord Chatham signalized himself in a manner worthy of the reputation which his political sagacity, however disregarded, and his manly eloquence, however inoperative, had acquired.

France joins America; death of Chatham.—The despondency of the ministers was somewhat relieved during the recess of parliament, by the exertions and encouragement of individuals for prosecuting the war. But it was evident at their next meeting that a modification of public opinion had taken place. Thus a motion by Mr Fox for abandoning the plan of conquest, was supported by the largest minority that had yet opposed the measures of administration; and Mr Burke's motion against the employment of Indians in the contest, though negatived, had 137 votes in its favour. Lord North, accordingly brought forward a plan for conciliating the colonists, which in reality was in substance what had before been recommended by the duke of Grafton. But a concession, such as it offered, was now too late; and it seemed the height of absurdity to imagine that America, having declared, and with hope contended for independence, would abandon it on the extorted confessions and virtual acknowledgment of inability to accomplish its object on the part of the British legislature. His lordship's propositions met with a very indifferent reception from some of his former supporters of the high prerogative party, as degrading to the country, and a pusillanimous concession to armed rebels; and the opposition, again, though they generally approved of them, were no ways sanguine as to their probable effect, and did not lose the opportunity which they afforded of conveying censure on the former system. The reflections of Mr Fox on the defence of the minister, were peculiarly galling, and had too much foundation in truth. "His lordship had attempted a justification of the most unjustifiable measures which had ever disgraced any government, or ruined any country. But his arguments might be collected into one point, his excuses were comprised in one apology,—in a single word,—ignorance; a palpable and total ignorance of every part of the subject. He had hoped, and was disappointed; expected a great deal, and found little to answer his expectations; he thought the Americans would have submitted to his laws, and they had resisted them; he thought again they would have submitted to his armies, and they had defeated them; he then made conciliatory propositions, and thought he would succeed, but they were rejected; he appointed commissioners to make peace, and he thought they had powers, but he found they could not make peace, and that they had not sufficient powers. The present concessions, had they been offered in time, would undoubtedly have been successful; for, however obscure his former propositions of conciliation might be deemed, necessity had at length compelled the noble lord to speak plain. But what censure would be found sufficient for those ministers who had adjourned parliament in order to make a proposition of conciliation, and then neglected to do it until *France had concluded a treaty with the united and independent States of America, and acknowledged them as such!*" The treaty thus first adverted to, was in a few days afterwards acknowledged by the ministry, and gave rise to an address to the throne, expressing the highest indignation at that kingdom, and assuring his majesty of the most zealous support of parliament. In the debate which occurred on moving an amendment to this address in the house of Lords, a very serious difference of opinion between certain members of opposition was brought to light, the existence of which, it is indubitable, materially tended to prolong the contest with the colonies. The Rockingham party, as might have been anticipated from their uniform principles, unreservedly admitted the independence of America, and asserted the total impossibility of recovering what had been wantonly thrown away. Not so the phalanx of which Lord Chatham was the chief, who had always, very unfortunately for his country, viewed that party with a jealous and averting eye, and whose last exertions, in deciding against this concession, shed a semblance of inconsistency on his political life. But there was a spirit of heroism in his indignant resistance to the final loss of so valuable an acquisition, which must ever rank with the most memorable events of the times. "My lords," said he, "I rejoice that the grave has not closed upon me, that I am still alive to lift up my voice against the dismemberment of this ancient and noble monarchy. Pressed down as I am by the load of infirmity, I am little able to assist my country in this most perilous conjuncture: but, my lords, while I have sense and memory, I never will consent to tarnish the lustre of this nation by an ignominious surrender of its rights and fairest possessions. Shall a people, so lately the terror of the world, now fall prostrate before the house of Bourbon? It is impossible! I am not, I confess, well informed of the resources of this kingdom; but I trust it has still sufficient to maintain its just rights, though I know them not. Any state, my Lords, is better than despair. Let us, at least, make one effort;—and if we must fall, let us fall like men." The duke of Richmond, whose motion had thus been opposed, having made a reply expressing his total ignorance of the means by which the combination of America with France could be successfully encountered, and calling on his lordship to point them out, if they were in existence, Lord Chatham rose again with eagerness, as if impatient to deliver some important idea; but before he had uttered a word, he fell down in a convulsion. The house immediately cleared; and the patriot, a little recovered, was conveyed to his villa in Kent, where, after languishing for several weeks, he died in the 70th year of his age.

Lord North's conciliatory plan fails.—The commissioners appointed, under Lord North's bill, to treat with the colonists, executed their mission so far effectually, that they left the Americans in a far worse state of irritation than they had found them; and thus the plan of conciliation was again defeated. Hostilities were carried on, in the meanwhile, in a most malignant manner, without any particular decision; but the accession of France to the the cause of America, gave no small addition of burden to the already distressed finances of Britain. The ministry still resolved on the vigorous prosecution of the war, and had the countenance of great majorities in voting a corresponding address to the speech from the throne, which opened the winter session. Yet was there something alarming to them in the unusually respectable numbers which supported the views of opposition on certain important occasions. A motion by the marquis of Rockingham, conveying censure on the American commissioners for a manifesto, in which they menaced the colonists with a *material change* in the subsequent conduct of the war, should they persevere in their obstinacy, was remarkable for the striking manner in which he addressed himself to the bench of bishops, but experienced a rejection, like every proposed measure from the same quarter. A protest, signed by thirty-one peers, among whom there was only one spiritual lord, Dr Shipley, bishop of St Asaph, testified at the same time the humanity and the failure of the noble mover.

Shipley's plan for dissenters.—The prelate now named, deserves more particular and highly commendatory notice, for an excellent and liberal speech in this parliament, in behalf of the protestant dissenters. He expressed his most cordial acquiescence in the repeal of those penal laws which had long been the disgrace of the national church; but he objected to the condition annexed to it, viz. the imposition of a confession of faith, however short, and general, and true,—such as he hoped he should have the virtue, if called upon, to seal with his blood. He absolutely disclaimed for himself any authority, civil or sacred, to impose this creed upon other men. By such imposition the present bill, which professes to repeal all former penal laws, is converted into a penal law itself; for those who do not subscribe the declarations still remain liable to them. The truth contained in the declaration, 'that the Scriptures are the revealed will of God, and the rule of faith and practice,' was, indeed, acknowledged by every protestant." "But supposing the existence of any set of Christians who should reject our canon of Scripture, who should build their faith on the basis of tradition, or on the supposed illumination of the Spirit, would you, my lords," said he, "persecute them for believing Christianity upon arguments that suit their own understandings? Such men would undoubtedly be in error; but *error in religion is the very ground and subject of toleration*."—"It is the duty of magistrates, it is, indeed, the very end of magistracy, to protect all men in the enjoyment of their natural rights, of which the free exercise of their religion is one of the first and best. All history is full of the mischiefs occasioned by the want of toleration; but no one has ever yet pretended to shew, that any public evils have been occasioned by toleration."—"The ruling party is always very liberal in bestowing the title of schismatic and heretic on those who differ from them in religion, and in representing them as dangerous to the state. But the contrary is the truth. Those who are uppermost, and have the power, are the men who do the mischief, while the schismatics only suffer and complain." "I am not afraid of those tender and scrupulous consciences who are over-cautious of professing or believing too much; if they are sincerely in the wrong, I forgive their errors, and respect their integrity. The men I am afraid of, are the men who believe every thing, and subscribe every thing, and who vote for every thing."

National difficulties increase.—Before the prorogation of parliament in 1779, a message from his majesty communicated the fact of an addition being made to the enemies of Britain, in a manifesto by the court of Spain. This event had been predicted by the opposition, but thought quite improbable on the part of the ministry. Its disclosure, therefore, afforded ample mortification and invective to the political combatants. The nation, however, was not yet sufficiently humbled to concede the independence of America, the condition on which Spain, certainly with some appearance of generosity, offered its mediation between the two countries. One highly important consequence of the alliance thus formed against Britain, was the necessity which Ireland felt for arming in its own defence,—a measure constituting an era in the history of that kingdom. The parliament, which met in November of this year, witnessed the renewed exertions of the opposition; but the motions for censure were still strongly negatived. In a debate on one of these, Lord Gower, in no small degree, sanctioned certain opinions which had long been entertained by the antagonists of the administration. "He had presided, he said, some years at the council-table, where he had seen such things pass, that no man of honour or conscience could any longer sit there! The times were such as called upon every man to speak out; sincerity and activity in councils could alone restore energy and effect to the government." By this time the delusion which had abused the public mind began to lose its efficacy, and the people, smarting under the accumulating evils of an unhappy war, became somewhat clamourous for economy, and a change of measures.

Success and failure of opposition.—This revulsion of sentiment was conspicuous on several occasions. A great number of the counties held meetings for the purpose of petitioning parliament for redress of grievances. York led the way, represented by Sir George Saville. The ruinous consequences of the war, the profuse expenditure, the undue influence of the crown, and the urgent necessity of correcting abuses, were stated in the strongest language. The petition was signed by more than eight thousand freeholders;—"it was first moved, said the baronet, in a meeting of six hundred gentlemen; and there was, he believed, more property in the hall where it was agreed to, than was contained within the walls of the house of Commons. It was a petition, therefore, to which the administration would not dare to refuse a hearing, however the arts of ministerial finesse might be employed to defeat its purpose." After a number of such petitions had been presented, Mr Burke brought forward his celebrated plan of reform, in one of the most brilliant speeches ever addressed to a popular assembly. It consisted of five separate bills, and was in part sustained, notwithstanding all the efforts of the ministry. But a signal victory was gained by the opposition on the 6th April, in the case of Mr Dunning's famous motion, "that the influence of the crown had increased, was increasing, and ought to be diminished." The minister on this occasion drew out all his forces, and was particularly supported by the lord advocate of Scotland, Henry Dundas, afterwards Lord Melville, who, by way of defeating the motion, proposed as an amendment, to prefix the words, "that it is now necessary to declare,"—an addition of so trivial a nature as to give no offence to the opposition. In the division on this amended resolution, there were 233 ayes, and only 215 noes, leaving a majority of eighteen against the court. This triumph was followed up by three motions, naturally rising out of the original proposition, which were all carried in defiance of the wishes, the entreaties, the deprecations, and protests of Lord North. He recovered a majority, not indeed the most encouraging, on another motion, by Mr Dunning, to address the king not to dissolve the parliament, or prorogue the session, till measures should be taken to diminish the influence of the crown, and correct the evils complained of. The opposition, so far successful, was imagined to have been not a little shorn of its strength during the adjournment occasioned by the speaker's illness. Some encouragement had no doubt been given to weak consciences by the minister, who again saw his ranks filled in a respectable manner, and thus, therefore, was blasted the hope which such a multiplicity of petitions, so respectfully recommended, and such strenuous endeavours, so prosperously commenced, had excited throughout the kingdom.

Lord George Gordon's riots.—The capital, in the month of June 1780, exhibited a frightful scene of confusion, riot, and outrage, the contemplation of which for a time absorbed every thought, and filled

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the mind with the serious apprehension that the bonds of social life were utterly dissolving. History must stigmatize the event as an enormous disgrace to any civilized country, and brand the agents as the odious abettors of an ignorant and brutal fanaticism. It is humiliating to be obliged to add, that the infuriated malignity which incurs such censure had its chief stimulus, if not its origin, from a part of the empire justly entitled to the distinction of superior education and liberality of sentiment. In the session of 1778, an act had been passed, relieving the Roman catholics from several heavy penalties which characterized the bigotry of a former century. This humane interposition of the legislature was generally commended in England, but received a very malign construction in the northern kingdom, in the capital of which some very indecorous proceedings, tolerated, if not actually sanctioned by the magistracy, resulted in a society denominated the "Protestant Association," intended to adopt measures for effectually opposing any concessions to papists. Of this disgusting fraternity Lord George Gordon was chosen president, a man of high connections, and some good parts, but whose judgment was totally bewildered in worthless conceits, and a still more worthless enthusiasm. The leaven of the association gradually extended to the sister kingdom, where, at last, it surmounted the bounds of common sense, as well as common humanity, and bade defiance to the legal authorities of the country. A petition for a repeal of the obnoxious law being prepared, was undertaken to be presented to parliament by the insane leader, as a member of the house of Commons, only on the express condition that he should be attended by no fewer than 20,000 men. But this requisition was vastly exceeded by the zeal or curiosity of the populace, who convened in St George's Fields on the 2d June of the present year. Their demeanour was at first peaceable enough, but as their fervour augmented, they became more and more unruly, and at last testified a total disregard to liberty of conscience and freedom of opinion. Their leader, during the debate on the petition, frequently addressed them without, in a manner calculated to inflame their minds, and not without success. On the adjournment of the house, the mob commenced their destructive operations, by demolishing some Roman catholic chapels. The following day was quietly got over, but on the next, which was Sunday, several such outrages were committed in the neighbourhood of Moorfields. Still more extensive was the devastation of Monday; and on Tuesday, which was the day appointed for considering the petition, the injurious intentions of the mob became more conspicuously alarming, by an attack on Newgate and Clerkenwell prisons, from which they liberated their comrades, and the destruction of Lord Mansfield's house in Bloomsbury Square. The succeeding day beheld the King's Bench, the Fleet prison, the New Compter, and a vast number of private dwellings, on fire; attempts were also made on the bank and post-office, but happily did not succeed. It was not till the evening of Thursday, nor without much bloodshed, that tranquillity was restored. Lord George Gordon being taken into custody, was tried for high treason, but acquitted, whereas a great number of the rioters, brought before the tribunal of Lord Loughborough, suffered the full rigour of the law. The general effect of this infamous disturbance was serviceable to administration, by producing the greatest dread of popular interference, however laudable or necessary the object might be. County associations, accordingly, got into disrepute, and were deserted by those who had formerly given them the highest encouragement.

War with Holland; Armed Neutrality.—The contest with America was carried on in the southern states with unrelenting energy. Charlestown had fallen into the hands of sir Henry Clinton; colonel Tarleton defeated the provincials at Waxsaw; and Lord Cornwallis was signally successful in South Carolina. But the operations in the north were less important. One of the most interesting events was the defection of general Arnold from the cause of his country, and his engaging in the royal service. The intercourse between him and sir Henry Clinton, which led to this desertion, proved fatal to the amiable and accomplished major André, who was seized as a spy, and executed in an ignominious manner, notwithstanding the urgent solicitations of the British general, and his own earnest request to have the death of a soldier. The joy of the ministry at Lord Cornwallis's success was very great, and gave rise to extravagant anticipations. To this cause may probably enough be ascribed the haughty manner in which the States-General were used at this period, and which ultimately brought on a war with them, not, however, without a degree of popular applause very unsuitable to the real distresses and embarrassments of the country. Thus Britain was engaged with no less than four enemies, without the aid of a single ally. But Holland was not the only power which complained of the violated rights of neutrality. The empress of Russia taking the lead in asserting the freedom of navigation, obtained the concurrence of the other northern states, in establishing the famous confederacy, known under the name of the "Armed Neutrality," which seemed to give satisfaction to every kingdom of Europe, with the exception of Britain, the power, in reality, against whose pretensions it was specially directed. One of the heaviest misfortunes experienced this year, was the capture by the Spaniards of the East and West India fleets in the bay of Biscay, a loss unparalleled in the commercial history of the country, since that of the Smyrna fleet in the time of king William.

Parliamentary proceedings 1781.—The events of the following year were very diversified, and materially affected the condition of the kingdom. It is proper to commence with the parliamentary proceedings. A communication as to the rupture with Holland, gave rise to a warm debate, in which Mr Burke and Mr Thomas Townshend distinguished themselves on the opposition principles, in the house of Commons, and the duke of Richmond and lord Camden among the Peers. But the responding addresses were nevertheless carried by great majorities. Mr Burke again brought forward his reform-bill, which was rejected by a majority of 233 to 190 voices. The debate, to which it now gave rise, was memorable for a speech in its support by Mr William Pitt, then a ve-

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ty young man, but already in possession of those great talents which he had afterwards such opportunities for displaying. The minister found himself still more warmly attacked on bringing forward the public account. His lordship's mode of negociating a loan for 12 millions afforded particular facility for the severest censure, which was dealt out to him unsparingly by Mr Fox: "In order to carry on a wicked, impolitic, and bloody war," said that intrepid orator, "the minister would not scruple to extort the last guinea from the pockets of the people. The noble lord stands convicted of having made, in the character of agent and trustee for the nation, an improvident, scandalous, and profligate bargain, for which he deserves public execration and exemplary punishment." But the minister still proved victorious, although it was perfectly obvious that gross abuses prevailed in the matter at issue. This was recorded by a protest of several peers in the upper-house, "in testimony of their strongest condemnation of the terms of the loan, and of the motives which they conceived dictated terms so very disadvantageous to the crown and the nation." And further, a motion afterwards made by Sir George Saville, for a select committee to inquire into its circumstances, was rejected by a majority of 46 only, in a house of near 400 members. A ministry of less impudence, or more feeling, would have construed such an expression into any thing rather than an approval of their conduct. But they required still stronger condemnatory indications to force them to a relinquishment of their offices. Near the end of the session, Mr Fox's motion for resolving the house into a committee to consider the cause of the American war, was ably supported by Mr Pitt, whose vehement language on this occasion might seem to have afforded an example and a precedent for the future invectives of his illustrious opponent: "It was a war," he said, "conceived in injustice, matured in folly, and whose footsteps were marked with slaughter and devastation. It exhibited the height of moral depravity and human turpitude. The nation was drained of its best blood, and its vital resources, for which nothing was received in return but a series of inefficient victories or disgraceful defeats,—victories obtained over men struggling in the holy cause of liberty,—or defeats which filled the land with mourning for the loss of dear and valuable relatives, slain in a detested and impious quarrel." This motion, too, was lost. Much of the present session was occupied in discussing the affairs of India; and particularly in reforming the judicial proceedings of the supreme civil court, against which complaints and petitions had been transmitted to parliament. A bill for new-modelling the supreme court of judicature at Calcutta, and for directing its future proceedings, passed into a law. After much discussion, a temporary bill was also passed, for continuing to the East India company the benefit of their exclusive trade and territorial possessions for a limited term, and for this boon they were at the same time charged with the sum of L.402,000.

India.—The military operations in India this year assumed a very formidable aspect. The success which had attended Hyder Ally, enabled him to augment his forces; but he was vigorously opposed by the British troops, when general Coote took the chief command in the Carnatic, and in three actions completely routed the enemy. In consequence of disputes arising between the rajah of Benares and the British government in India, a new rajah was appointed, and a larger tribute was obtained by the company. When the intelligence of the Dutch war reached India, in August, the settlements in the island of Sumatra, belonging to the states of Holland, were attacked, and fell an easy prey to British authority. The port and fortress of Negapatam, in the Tanjore country, was a more difficult enterprise, but at last shared the same fate.

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America.—The embarrassed state of the American finances, the consequent privations to which their army was subjected, and the murmuring and discontent which had long prevailed in it, and at last broke out into open mutiny, gave some hope that their less vigorous resistance would be followed with better success to the British arms. Lord Cornwallis having made preparations for active warfare, entered into North Carolina, was opposed in that quarter by general Greene, and, after various movements, defeated the army of the latter; but not being in a condition to pursue his advantages, he found it necessary to withdraw his exhausted troops to the vicinity of Wilmington. Finding his situation at this place insecure, the British commander formed the resolution of marching to Virginia to effect a junction with the army in that quarter; and in the course of a month from the end of April, he reached Petersburgh. In August he took post with 7000 troops at York town, which stands on a peninsular spot between the rivers York and James, and proceeded to strengthen it with the necessary fortifications. This place was selected as a permanent station, from which enterprizes might be carried on both by sea and land. Before this time general Arnold, with a body of troops, had conducted a kind of marauding expedition along the shores of Virginia and the banks of its rivers, and, driving the different parties of the militia of the country before him, had destroyed ships, naval stores, and merchandise to a great amount. But, in the meantime, Washington gave out that it was his intention, in conjunction with the French, to attack New-York, while his real purpose, in the movements which he began to make, was the relief of Virginia. To continue the deception, the combined French and American troops approached very near to New-York; but suddenly crossing the north river, and marching through the Jerseys to Philadelphia, they proceeded afterwards, partly by land, and partly by sea, to Baltimore, and finally arrived at Annapolis in Maryland.

The British and French fleets, the former consisting of 19, the latter of 24 ships of the line, had a partial engagement off the mouth of the Chesapeak; and the French having been reinforced by a squadron off Rhode-island, remained masters of the river, while the British ships retired to New-York. To prevent Lord Cornwallis from retreating to Carolina, Count de Grasse, the French admiral, blocked up York-river, and with his armed vessels occupied a considerable extent of James-river. The British commander was now completely invested in Yorktown, by an army of about 16,000 French and American troops, and 5000 militia, and had no other defence than earthen works hastily thrown up. On the 6th October, the trenches were opened against him, with nearly 100 pieces of heavy cannon. But after a spirited resistance, and a successful sortie from the British lines, he was compelled, on the 19th, to surrender, when between 5000 and 6000 men, many of whom were sick or wounded, and 1500 sailors, became prisoners of war.

Naval enterprises.—A fleet of 27 sail of the line, under the command of admiral Darby, sailed on the 13th March for the relief of Gibraltar, the garrison of which, from the close blockade, was now subject to great privations from the want of provisions. He effected his purpose without being disturbed by the Spanish fleet, which, to the amount of 30 sail of the line, was then cruizing near Cadiz. A small squadron, under the command of commodore Johnstone, sailed from England at the same time, with 3000 land-forces, for the purpose of reducing the Cape of Good Hope. During the voyage, a smart engagement took place with a French squadron under admiral Suffrein, who arrived first at the Cape, and landed some French troops. Commodore Johnstone, thus anticipated, deemed any attempt on Cape-town impracticable, and confined his operations to an attack on some Dutch East Indiamen in Saldanha bay. The crews of the Dutch ships run their vessels on shore and set fire to them; but by the active exertions of the British seamen, four large ships were rescued from the flames, and the commodore, with his own ship and the frigates, conveyed his prizes to England, while general Meadows, commanding the land forces, proceeded with the rest of the fleet to India.

West Indies.—The West Indies was the scene of some important transactions this year. An expedition under admiral Rodney and general Vaughan, for the recovery of St Vincent, was relinquished without hazarding an attack; but the Dutch island of St. Eustatius surrendered to the same force, without any resistance on the part of the governor, who had not heard of the commencement of hostilities between the two countries. As this island had been for some time a free port and general emporium for West Indian and American produce, immense booty was obtained; and, besides merchandise to the amount of more than 3 millions Sterling, above 250 vessels, with rich cargoes on board, fell into the hands of the captors; while a fleet of thirty West Indiamen, which had shortly before sailed for Holland, was taken by two men of war, and a frigate sent after them. The inhabitants of this ill-fated island were treated with great rigour; indiscriminate confiscations of private property took place, and several of the Jews were condemned to banishment, and transported to St. Christophers. The island was recovered by a small force, under the marquis de Bouille in November, and a good deal of spoil still remained to enrich the victors.

Engagement with the Dutch fleet.—A large convoy protected by a force of eight ships of the line, ten frigates, and five sloops, sailed from the Texel in July, and having fallen in with the British fleet, of nearly equal force, under the command of admiral Hyde Parker, on the Dogger-bank, on the 5th August, a dreadful conflict commenced, and continued for nearly four hours; no ship was taken or sunk during the action; but one of the Dutch ships of 68 guns went down in the night, with all her wounded men, before she reached port.

Combined fleet of France and Spain.—The combined French and Spanish fleet, consisting of 49 ships of the line, appeared off the mouth of the English channel; and admiral Darby, with 21 British ships of the line only, from defective intelligence, narrowly escaped this superior force, and, having returned to Torbay, moored his ships across the entrance. Being reinforced with some ships, which gave him the command of a fleet of thirty sail, he was ordered to sea to protect a West India convoy which was then expected; but he was detained by contrary winds in Torbay till the middle of September; and after deliberating on the propriety of attacking him in that position, the French and Spanish commanders returned to their respective ports. The French fleet was refitted at Brest, and sailed in December with 19 ships of the line and a large fleet of transports, for the East and West Indies, under convoy; admiral Kempenfelt, with only 12 sail of the line, a 50 gun ship, and 4 frigates, fell in with the French fleet during a gale of wind, when it was considerably dispersed; and of the convoy, which had fallen astern, he captured 20 ships, laden with warlike stores; but no engagement took place between the hostile fleets.

1782.—The meeting of parliament, after the Christmas recess, was occupied with a motion for an inquiry into the conduct of the first lord of the admiralty; and the subject of the American war being introduced a second time, a resolution was moved, containing a declaration against offensive war with America. The latter motion was carried by a majority, as well as an address to the king, formed upon the resolution. From the change of sentiment in the house of Commons, it was expected that the prime minister would have retired from an office in performing the duties of which he had lost the confidence of parliament. That period at last arrived, when Lord North declared in the house that the administration was dissolved.

New ministry.—In the new ministerial arrangement the marquis of Rockingham was appointed first lord of the Treasury; the earl of Shelburne and Mr Fox secretaries of State; Lord Camden president of the Council; the duke of Grafton lord Privy-seal; Lord John Cavendish chancellor of the Exchequer; admiral Keppel, then created a viscount, first lord of the Admiralty; the duke of Richmond master-general of the Ordnance; the duke of Portland Lord-lieutenant of Ireland, and Lord Thurlow was continued lord Chancellor.

The discontents in Ireland formed the subject of consideration in the house of Commons early in April; and the causes of these complaints being removed by the interference of the British legislature, the Irish parliament voted L.100,000 for raising 20,000 Irish seamen. Various plans for promoting economy and reform were introduced by the new ministry. Mr Pitt's political career commenced with a

Civil history. proposal for a committee to inquire into the state of the representation in parliament. But while the new ministry were still engaged in their plans of improvement, the death of the marquis of Rockingham produced a very material change in their arrangements. He was succeeded by the earl of Shelburne; and, in consequence of great differences having existed in the cabinet between the most distinguished persons in the administration, Mr Pitt was appointed chancellor of the Exchequer. The affairs of India occupied a large share of the attention of parliament during the whole of the session.

West Indies.—The West Indies was the chief scene of the war during this year. In the early part of it, Demerara and Essequibo were retaken by the French and restored to Holland; the marquis de Bouillé with 8000 men took St Christophers, and the islands of Nevis and Montserrat shared the same fate; and great apprehensions were entertained for Jamaica, which it was scarcely expected could resist the immense force which the French and Spaniards then possessed in the West Indies, if once combined and skilfully directed. It was the object of the British admiral to bring the French fleet to an engagement before this junction was effected. On the 8th April, De Grasse sailed from Martinique; and intelligence of this movement having reached Sir George Rodney, the commander of the British fleet, he sailed instantly in pursuit of the enemy; came in sight, off Dominica, the same night; and next day the van of the British engaged with the main body of the French. In this rencounter two of the French ships were disabled, and left the fleet. Some of the English ships also suffered greatly, but kept their station.

Rodney's naval victory.—On the 11th of April the body of the French fleet was nearly out of sight, when two of the ships that had been damaged in the action of the preceding day were observed to fall off from the rest, and would have been cut off, had not De Grasse, with his whole fleet, bore down to save them. By this movement, the British had an opportunity of bringing on a general engagement, which commenced early next morning, and continued till sunset, with the most determined courage on both sides. In this action, Rodney was the first who put in practice the manœuvre of breaking the enemy's line, which, on many occasions since his time, has given such decided advantages to the British navy. The French admiral's ship, the Ville de Paris, of 112 guns, after dreadful carnage, struck her flag to Sir Samuel Hood, in the Barfleur. Four other ships of the line were also taken, and another was sunk in the engagement; and two more ships and two frigates fell into the hands of the victors some days afterwards. Not a ship of the English fleet was lost, and the whole loss of men did not exceed the number killed in the French commander's ship alone. Admiral Rodney, on his arrival at Jamaica, was hailed as the saviour of the island, and on his return to England was rewarded with a peerage.

Other military operations.—The Bahama islands were reduced by a Spanish armament from Cuba; a French squadron was sent out against the settlements of the Hudson's-bay company, which were not prepared for resistance; and the buildings being destroyed, one magazine excepted, which La Perouse, the commander of the expedition, humanely left furnished with provisions for the winter supply of the merchants, who had fled to the woods, the invaders returned without molestation; and the Dutch lost some of their settlements on the coast of Africa. In the bay of Biscay, admiral Barrington took a large French ship, and twelve of her convoy, with troops and stores, for the East Indies; and the combined French and Spanish fleets from Cadiz fell in with the outward bound Newfoundland and Quebec fleets, and captured eighteen ships.

Memorable attack on Gibraltar.—All the resources of power and ingenuity were called into action by the Spaniards, to recover possession of the fortress of Gibraltar; the preparations this year exceeded every former attempt; ten floating batteries, so constructed that they were supposed to be secured against sinking or being set on fire, were furnished with brass cannon of great weight; a fleet of 48 sail was in readiness to co-operate; new batteries were opened on the land side; and the aid of 12,000 French troops gave spirit and vigour to the Spanish army. The battering vessels, moored at the distance of 900 yards from the rock, began the cannonading on the morning of the 13th of September; but the irresistible showers of red-hot shot from the fortress struck terror and dismay among the besiegers; smoke and flames appeared in the ships, which blew up in succession, and next day not a vestige was seen of this formidable armament. The loss of men among the enemy, who were killed or perished in the flames, was very great; while the number killed, and the damage sustained in the garrison, on this memorable day, was comparatively trifling. An attempt made by the enemy to cut off the garrison from the supply of stores and provisions, was fortunately frustrated by the skill and bravery of Lord Howe, who completely succeeded in protecting the convoy to the port of Gibraltar, in the face of a fleet greatly superior.

Naval disasters.—The Royal George, of 108 guns, and one of the finest ships in the British navy, being at anchor at Portsmouth, was heeled to one side to examine the lower works, and in that position being thrown off the balance by a squall while the ports were open, the water rushed in, and she instantly went to the bottom, with admiral Kempenfelt, all her officers, and eight or nine hundred persons on board. A fleet of 100 merchantmen from Jamaica, under convoy of seven ships of war, some of which were French prizes taken by admiral Rodney, were overtaken, on the 16th September, by a dreadful gale on the banks of Newfoundland. Many of the merchant ships perished in the storm; five of the men-of-war never reached land; and of the fate of the Ville de Paris, the boast of France, and the noble trophy of the splendid British victory, a single individual, who was found floating on a piece of the wreck, only survived to communicate the intelligence.

North America.—No active warfare was carried on in America. The hostile armies in New-York and its vicinity were so nearly equal in strength, that they seemed little disposed to come to close quarters. But, on the 30th of November, the provisional articles of peace were signed at Paris, between the commissioner from Britain and those from the United States, in which the independence of the latter was fully recognized; and thus the long-protracted struggle was brought to a termination.

East-Indies.—The military operations in the East Indies were numerous and important. Trincomalee, in Ceylon, was taken by Sir Edward Hughes, in the end of the preceding year; but this valuable settlement and port was recaptured by the French admiral Suffrein in the present. The war with Hyder Ally and his son, Tippoo, was carried on with various success, till the termination of hostilities in June next year, when the intelligence of a general peace reached India.

1783.—The subject of the peace with France, Spain, and America, formed the most important discussion in parliament at its meeting after the recess; and, on a division, the majority was against the ministry. A resignation followed, and the famous *coalition ministry*, one of the most remarkable political events of the times, was formed. It was so denominated from the singular union of persons of opposite parties. The duke of Portland was first lord of the Treasury, Lord North and Mr Fox secretaries of State, and Lord John Cavendish chancellor of the Exchequer. Parliament was much occupied in arranging and settling the affairs of Ireland, some domestic concerns connected with Great Britain, and particularly with the India bill, the object of which was the regulation of the affairs of the East India company. This bill was rejected in the house of Lords, and the same day the two secretaries of State were required to deliver up the seals of their office. The new ministry was formed on the succeeding day, at the head of which was placed Mr Pitt, then only in his 24th year, as first lord of the Treasury and chancellor of the Exchequer.

1784.—When parliament met in January, a singular spectacle was exhibited of a ministry retaining its place while at open variance with the house of Commons; and various motions were presented and carried hostile to administration. Parliament was at last dissolved, and when it met on the 18th May, the state of affairs assumed a very different aspect. The amendment on the address was rejected by a large majority. Among the proceedings of parliament, the commutation act, by which the duty on tea was lowered with the view of preventing smuggling, and the window tax was increased in proportion; and the establishment of the board of controul, the members of which were to be nominated by the king, for the government of the affairs of the East India company, formed the chief features. The financial estimates included a loan of six millions, and some new taxes; and an act was passed for the restoration of the estates in Scotland forfeited by those who were engaged in the rebellion in 1745.

In the end of last year the subject of reform in parliament excited a great ferment in Ireland. At a meeting of delegates from the province of Ulster, held at Dungannon, it was resolved that a convention of representatives from the whole volunteer army should assemble at Dublin. The convention met, and the plan of reformation was produced and considered, and the day following a motion was made in the house of Commons, for leave to bring in a bill for the more equal representation of the people in parliament. This motion, as being supported by the force of arms, was rejected by a great majority. The subject was renewed in parliament early in the present year, and met with a similar fate. The citizens of Dublin, exasperated at this defeat, held an aggregate meeting, and addressed circular letters with a proposal for a national congress to assemble in Dublin, and composed of five persons elected from every county, city, and town. The most vigorous measures were adopted by government to prevent such a meeting from taking place. But the congress assembled on the 25th October, though in an incomplete form; various resolutions were passed, and a strong recommendation was issued for a full and better organized meeting at a future period. The distress of the manufacturers of Dublin was another cause of great discontent and popular commotion; and the motion for imposing protecting duties in favour of Irish manufactures being rejected in the house of Commons, a violent disturbance took place among the populace, and the mob actually broke into the house and reproached the members for their partiality to the interests of England; but they were fortunately repulsed by the guards without bloodshed.

1785.—One of the first subjects which came under the consideration of parliament, was the affair of the Westminster election, in which a scrutiny had been demanded by one of the candidates. A warm discussion followed, in which a good deal of personal altercation took place between some of the principal speakers. The debts of the nabob of Arcot was another topic of parliamentary investigation; but the motion for a more strict scrutiny into the nature of these debts was lost by a considerable majority. Mr Pitt, following up the plans of reform which he had projected before he came into administration, made a motion for leave to bring in a bill to amend the representation of the people in parliament. He proposed to transfer the right of electing representatives from the decayed boroughs, to the counties and principal unrepresented towns; giving to the owners and holders of the disfranchised boroughs a pecuniary compensation, and to extend the right of voting for knights of the shire to copy-holders. This scheme of compensation was not approved, and, after a long and keen debate, the motion was negatived.

Ireland.—The propositions introduced into parliament during this session for adjusting the commercial intercourse between Great Britain and Ireland, occupied a large share of its attention; but the discontents still continued in the sister kingdom. The national congress for parliamentary reform met in January, and held several adjourned meetings; and a bill on the same subject being brought into the house of Commons, was again rejected; the city of Dublin continued through the summer in a state of great perturbation; and the interference of the military was required for the suppression of mobs and riotous proceedings.

1786.—The first important question which was brought into parliament, was a measure proposed by the duke of Richmond of fortifying the dock-yards of Portsmouth and Plymouth, at an expence of L.760,000, the amount of the estimate calculated by a board of engineers. An animated discussion followed, and when the division took place, the numbers on each side being exactly equal, the plan was rejected by the casting vote of the speaker. Mr Pitt's celebrated scheme for the gradual reduction of the national debt, was brought forward in March; and, according to this plan, one million Sterling, was granted annually to commissioners, to be appropriated as a sinking fund, for the purpose alluded to. The policy of the principle now adopted, of making the income of the state so far exceed its expenditure as to leave a surplus for diminishing the national debt, was universally acknowledged, and the motion was carried without a division; but some objections were made to the mode proposed for effecting this purpose.

The affairs of India also occupied a good deal of the attention of parliament; a bill was passed for enlarging the powers of the governor-general; and the celebrated prosecution of Mr Hastings commenced during this session. During this year, a treaty of commerce and navigation, between Britain and France, was signed at Versailles; and among other conditions of the agreement now entered into between the two kingdoms, the right claimed by the crown of France, to the property of foreigners dying in that country, was abrogated with regard to the subjects of Britain.

Attempt on the life of the king.—Among the remarkable domestic incidents of this year, may be noticed an attempt made by a woman on his majesty's life, while she presented a paper as he was alighting from his carriage at the garden gate of St James's. A blow which she made at his breast with a concealed knife, was fortunately eluded, and as she was about to aim a second stroke, her hand was seized by a yeoman of the guard, and the knife taken from her, while the king, with great coolness and humanity, exclaimed, "I am not hurt; take care of the poor woman, do not hurt her." When she was examined before the privy council, she was found to be one Margaret Nicholson, a person in obscure circumstances from the north of England, and labouring under mental derangement, who had entertained some incoherent notions of right to the crown. As the insanity of this woman was quite obvious, she was not considered a fit object of punishment, and was therefore committed to safe custody as a lunatic.

1787.—The discussion of the commercial treaty lately concluded with France, formed one of the chief topics of consideration on the meeting of parliament. Another important subject of deliberation was, a plan proposed by Mr Pitt for the consolidation of the several duties upon articles in the customs and the excise, and to convert them into single duties upon each article. A motion was also made this session for taking into consideration the repeal of the corporation and test acts; but, after a warm debate, it was negatived.

The preliminary steps for the prosecution of Mr Hastings, formed a prominent part of the transactions of parliament; and whatever opinions may be formed of the influence of party or personal feelings in bringing forward the charges against the governor-general, scarcely any subject before agitated in that assembly afforded so brilliant a display of powerful eloquence. The animated, impressive, and impassioned speeches of Burke and Sheridan on this interesting occasion, have been rarely equalled, and never surpassed, either in ancient or modern times.

Parliament was assembled for the winter-session in November; and the interference of government in the affairs of the United Provinces being noticed in the speech from the throne, became the subject of deliberation. A fleet had been ordered to be equipped, and the land forces recruited. Similar hostile preparations were made on the part of France; but the contests in Holland being settled by the interposition of a Prussian army, a convention took place between Britain and France, for the mutual reduction of their armed force.

1788.—The subjects which occupied the attention of parliament on its meeting after the recess were, a naval promotion declared by the board of admiralty, in which more than forty captains had been passed over, and 16 were advanced to a flag; the right vested in the board of controul of sending troops to India; an additional clause to the mutiny-act, for incorporating in the army a corps of military artificers newly raised; and further regulations for settling controverted elections. The abolition of the African slave-trade was first introduced into parliament this year; and some excellent regulations were adopted for limiting the number of slaves to the tonnage of the vessel in which they are conveyed, and other arrangements connected with their health and comfort. The sum of L.1,340,000 was voted to the American loyalists, in compensation for their sufferings during the war.

Treaties.—A treaty of defensive alliance between Great Britain and the States-general of the United Provinces was signed at the Hague in April, according to the tenor of which, each country was bound to succour the other, by sea and land, if attacked by any European power, and to guarantee each other in the possession of all their dominions. A similar treaty with Prussia, in which the conditions were similar, was signed at Berlin in August.

King's illness.—The mental disorder of the king could now be no longer concealed; and parliament, after an adjournment of fifteen days from the 20th of November, the day to which it had been prorogued, proceeded to make provision for the present or any future incapacity of the executive power; and, after keen debates, it was maintained by the minister, that in such cases it belonged to the houses of parliament to provide the means for supplying the defect of the personal exercise of the royal authority, while it was asserted by the opposition, that the heir-apparent had an indisputable claim to the exercise of the executive power in such cases.

Centenary of the revolution.—A century having elapsed from the important era of the revolution, that event was commemorated this year by extraordinary rejoicings in almost every part of the kingdom. In Dublin, the birth-day of king William was observed with great solemnity.

1789.—The regency-bill was the first subject of parliamentary consideration; and, after long discussion, the conditions and restrictions being agreed to, committees were appointed by the two houses of parliament to present their resolutions to the Queen and the prince of Wales, whose answers implied their acceptance of the trust to be reposed in them. But while the matter was under discussion, the king's recovery interrupted farther proceedings. The national rejoicings on this occasion exceeded every thing of the kind before known; most splendid illuminations were exhibited throughout the kingdom; a day of general thanksgiving was appointed; and the king in person, attended by the royal family, the great officers of state, and both houses of parliament, went in grand procession to St Paul's.

1790.—*French Revolution.*—The enlightened principles which at first seemed to actuate those concerned in the French revolution, produced corresponding sentiments in the liberal minded, who could, at a distance, calmly contemplate that extraordinary event. In Britain, it was hailed as the era of freedom to an oppressed people; the period of its commencement was celebrated with great triumph in many parts of the kingdom; and the views which it held out, and the rights which it maintained, became the topics of keen and violent controversy, both in conversation and writings. Mr Burke's celebrated work, "Reflections on the French Revolution," and "Paine's Rights of Man," contributed not a little to inflame the zeal of those who took opposite sides of this important question. But whatever were the opinions entertained at the time, the issue of that tremendous struggle holds out an awful warning to mankind of the dangers of popular commotion, excited and encouraged by evil passions, and followed by tumult, bloodshed, and death.

The States-general of France was opened at Versailles on the 5th May of the preceding year, and, on a dispute of some points of form, was soon resolved into the *national assembly;* the Bastile was stormed by the Parisians on the 14th of July; a declaration of rights, as the base of the new constitution, was agreed to, and passed in August; an insurrection broke out in Paris and Versailles, from which the royal family with difficulty escaped, and was attacked by a mob. France was divided into departments,—the distinction of orders was abolished,—tithes, and all ecclesiastical property were resumed,—monastic institutions were suppressed, and new courts of justice with trial by jury established. In the present year, the assembly passed a decree abolishing all hereditary titles, and every other mark of distinction of ranks in society; the general confederation, as it was called, was celebrated on the anniversary of the taking of the Bastile, when oaths of fidelity to the new constitution were administered to the king and the whole national assembly; the same solemnity was observed throughout the kingdom; a similar oath was imposed on the clergy, but almost the whole of the episcopal order, and a great number of the inferior clergy declined it; and, to avoid the penalties by which it was sanctioned, numerous emigrations took place.

The affairs of France, in consequence of the dreadful political storm which had been long gathering, excited great interest and diversity of opinion in this country; and in the speech from the throne, at the opening of parliament in January, an expression of regret was introduced for the internal commotions which disturbed the tranquillity of different parts of Europe. The subject of the French revolution soon after came before the house, and while it was spoken of in terms of approbation by one party, it was reprobated by another, and particularly by Mr Burke, who, in a most eloquent harangue, pronounced a severe censure on the principles and conduct of that event.

Nootka sound.—A dispute with the Spaniards concerning their exclusive claim to a navigation of the South seas, and their right to a settlement at Nootka sound on the coast of California, and, as a consequence of these pretended rights, the seizure of two English vessels by a Spanish frigate, led to serious hostile preparations. Vigorous exertions for war were made on both sides; but the dispute was adjusted by a convention, in which Spain agreed to the restoration of the settlement, reparation of the injury sustained, and to a free navigation and fishery in the Pacific ocean and South sea by British subjects

1791.—Among the earliest proceedings of parliament this year, a bill for the relief of the English Roman catholics passed into a law; but a petition from the general assembly of the church of Scotland, for a repeal of the test acts, as far as regards the members of that church being required to take the sacrament according to the form of the church of England, before admission to public offices, was rejected by a great majority. New regulations for the government of Canada, by which that province was divided into two districts, the Upper and Lower, were adopted; the slave trade was again discussed; the war between Russia and the Ottoman Porte came under consideration, with a message from the king that the aspect of affairs between these powers rendered it a prudent measure to augment his naval forces; and a bill also passed for a new settlement at Sierra Leone, for the culture of sugar, and other tropical productions, by free negroes.

Riots at Birmingham.—The violence of party spirit was not at all diminished at this time. In some places, indeed, it burst forth with redoubled fury. The celebration of the anniversary of the taking of the Bastile, which took place in various places of Britain, produced a good deal of political rancour in the different parties who espoused or disapproved the measures of the French reformers, and at Birmingham it terminated in a destructive riot. The populace collected together in a great mob, and directed their ungovernable rage chiefly against the dissenters, some of whose meeting-houses and private dwellings were reduced to ashes. The house, books, and apparatus of Dr Priestley were totally destroyed; and this scene of tumult and misrule having raged four days, and spread to the neighbouring districts, was only suppressed by military force.

France.—The system of revolution in France proceeding with unabated violence, became an object of great solicitude to surrounding nations. Emigrations continued from that distracted country; many members of the royal family sought an asylum in a foreign land; the king, queen, and their party escaped from the Thuilleries, but were seized at Varennes, and conducted back under an escort of the national guard; the constituent assembly dissolved itself, after decreeing that none of its members should be eligible to next assembly; popular societies were assuming a dangerous influence, of which the famous Jacobin club became the most conspicuous, and finally an instrument of the most violent faction; and an emigrant army, under the prince of Condé, was assembled on the German frontiers.

1792.—At the opening of parliament in the end of January, a confident hope was expressed, in the speech from the throne, that the state of Europe, and the assurances received from foreign powers, promised a continuance of tranquillity to this country; and the financial statement presented to the house of Commons, from which it appeared that the permanent income would exceed the permanent expenditure, including the annual million for extinguishing the national debt, by L.400,000, exhibited a flattering prospect of the national prosperity. The question of the abolition of the slave-trade was again agitated in parliament, and the motion for a gradual abolition was carried by a majority; but in the house of Lords the measure was less cordially received, and a committee being appointed for hearing evidence of the subject, no definite period could be fixed for its decision.

Reform societies.—A society under the name of the "Friends of the People," was established in the metropolis, for the purpose of promoting a reform of the parliamentary representation; and a notice being given in the house of Commons that the objects of the society would be brought under their consideration in the ensuing session, it was opposed by the minister, and all those who thought it highly inexpedient and dangerous, with the example of the French revolution before them, to yield in any point to a spirit of innovation. A royal proclamation was issued for preventing seditious meetings and publications, and prosecutions were commenced against many persons for circulating obnoxious publications.

Affairs of France.—Austria and Prussia had now determined to invade the French territories in support of Louis and the royal authority; and the duke of Brunswick, at the head of the combined armies, published two declarations in July, which produced a strong sensation in France. The deposition of Louis was proposed in the assembly; the fury of the populace rose to a high pitch; the palace of the Thuilleries was attacked on the 10th August; the Swiss guards were overpowered, and either fell in the struggle, or were massacred in cold blood, and every person who was an object of suspicion or hatred to a desperate mob fell a sacrifice to their savage fury; the royal authority was revoked or suspended; and the king and queen were confined in the Temple. But when the dreadful tocsin was sounded on the 2d September, a scene of massacre and bloodshed, which has scarcely had a parallel, was exhibited. Some priests doomed to banishment were the first victims; and on this and the following day more than one thousand persons, detained under suspicion, were assassinated. The abolition of royalty was voted in the national convention; and, under the assumed form of a republic, the very frame of society seemed to be broken down; the common terms of respect, and all distinctions in society, were laid aside; and the ordinary courtesies of polished life were treated with contempt. In the meantime, the French armies were successful in defending their territory; and the battle of Jemappe, gained by Dumourier, gave them the command of the Netherlands. The period was now approaching when Britain was no longer to be a passive spectator of these events; the deposition of Louis occasioned the recal of the British ambassador; the free navigation of the Scheldt being declared by the French, the English ministry made an offer of assistance to the Dutch; proclamations were issued to suppress seditious meetings; and, in the king's speech to parliament, which met in December, the necessity of augmenting the naval and military forces was declared.

East Indies.—The war with Tippoo sultan, which had proceeded with various success in the former year, was brought to a conclusion about the commencement of the present. Lord Cornwallis, with his allies, having appeared a second time before Seringapatam, and having succeeded in an attack on Tippoo's camp, he completely invested the capital. The siege was vigorously pushed, and the sultan, from the desperate situation of his affairs, was compelled to submission, by ceding half his dominions to the allied powers, paying a large sum of money by way of indemnities, releasing all the prisoners, and delivering his two eldest sons as hostages for the performance of the conditions.

1793.—The trial of Louis, for which preparations were made in the end of last year, and the condemnation and public execution of that unfortunate monarch on the 21st January, excited the strongest sentiments of abhorrence in Britain towards the French republic; and an order was issued from his majesty for the departure of the French ambassador from the kingdom within eight days. War was declared by the national convention against England and Holland on the 1st February; and Dumourier, with the view of penetrating into Holland, made an unsuccessful attack on the fortress of Williamstadt, which was defended by a detachment of English guards, and some Dutch and English gun-boats. After various military movements, the consequence of which was the recovery of the Austrian Netherlands from the French, Dumourier, who had meditated a plan for effecting a counter-revolution, went over with a small body of troops to the Austrian general Clairfait. His successor, Dampierre, in the command of the French army, attacked the Austrian and Prussian posts, which were supported by the British troops under the duke of York, and was repulsed. Valenciennes was then invested, and surrendered in July; the duke of York proceeded to Dunkirk in August, and laid siege to that town; but the want of naval co-operation, and the delay in the arrival of his heavy artillery, gave the French time to collect a powerful force, on the approach of which he was obliged to raise the siege.

While these and other offensive operations were carrying on against France from without, she was torn with the most furious dissensions and violence of contending parties at home; and scenes of the most ferocious cruelty and savage barbarity were daily exhibited, in the murders and executions of those who espoused opposite interests, and were denounced enemies of the republic. Among other victims was the queen of France, who, after being treated as the meanest criminal, during a long imprisonment of ten weeks, was guillotined on the 26th October; 21 deputies soon after suffered the same fate; and to these was added the execution of the duke of Orleans, of infamous character, and who voted against the life of the king, and of the celebrated Madame Roland, the wife of the minister. The formation of a new calendar was another remarkable feature in the spirit of innovation which guided the proceedings of the convention. It seemed to be the object of these who constructed it to obliterate the memory of Sundays, and to retain no allusion to any former religious observances.

Military operations.—Early in the year the British army and navy was actively employed against the French colonies in the West Indies; and soon after the intelligence of the declaration of war reached India, all their possessions on that continent yielded to the arms of Britain.

1794.—The vigorous prosecution of the war was strongly recommended in the speech from the throne at the opening of parliament. Beside the financial arrangements, for which a supply of nearly 20 millions was calculated, the subject of the war, the raising of the volunteer force, which had been recommended by the ministry, the subsidiary treaties with foreign powers, the suspension of the *habeas corpus* act, and proposals from the opposition for negociating with France, with the view of terminating the war, were the topics of much parliamentary discussion. The case of Muir and Palmer was also brought before parliament. They had been convicted of sedition in Scotland; but the sentence of transportation was thought too severe, and excited pretty general commiseration.

Trials for treason.—A bill of indictment was found against thirteen members of the reforming societies. Hardy, the secretary of the society, was first brought forward, and, after a trial of eight days, was pronounced *not guilty*. The trial of Horne Tooke, and of Thelwall, which successively followed, had a similar issue.

France.—The French were generally successful in their progress in the Netherlands against the allied forces, and by the end of July the whole of Austrian Flanders and Brabant fell under their dominion. On the German borders, the issue of the campaign was not less prosperous to the French republic; and before the close of the year, the invasion of Holland became the great object of their hostile movements. On the Spanish frontier their arms were also victorious; and in Italy they defeated a combined force of Austrians and Sardinians, beside gaining other material advantages. But in their domestic affairs the same ferocious spirit marked all the actions of those who held the reins of government. The noted Robespierre, along with two others, had now the uncontrouled sway of the executive power. Daily executions now took place, among whom were one of his colleagues, accused of a conspiracy, and the princess Elizabeth, sister of the late king, against whom some frivolous charges were made; but a party in the convention at last rose up against his intolerable tyranny, and he was seized, condemned, and executed, amidst the execrations of the people.

West Indies.—Martinique, after a vigorous resistance, was reduced by the forces under the command of Sir Charles Grey, and the fleet under Sir John Jervis. The island of Guadaloupe, with its dependencies, was brought to capitulation, and St Lucia also surrendered; but in consequence of the ravages of the yellow fever among the British troops, and the succour sent from France, Guadaloupe was recovered, and fell under the dominion of its former masters.

Lord Howe's naval victory.—Eager to dispute the sovereignty of the sea, the French had made great exertions for the equipment of a powerful fleet in Brest harbour, where it had been blocked up by the Channel fleet, under Lord Howe, for some time. During his absence from the station about the middle of May, an opportunity offered of putting to sea; and it was not till the 28th of the month, that the British fleet came in sight of the enemy off the coast of Britany. After some partial actions, Lord Howe gained the weather gauge, and with 25 ships of the line attacked the French fleet, consisting of 26 ships of the line. The French waited the onset with great steadiness; but in less than an hour after the centre was engaged in close action, their admiral, who was opposed to the British commander in the Queen Charlotte, aware of the issue of the contest, went off with crowded sails, and was followed by most of his van who were in a condition to carry canvas. One of the French ships went down during the action; and of her crew, who, in the ardour of enthusiasm, were heard shouting *vive la republique*, at the moment they were sinking into a watery grave, not one man was saved. Seven ships were captured, but one of them sunk almost as soon as she came into the possession of the victors. The carnage on board the French fleet was dreadful, for the amount of the killed and wounded in the captured ships alone was 1270. The loss of the British was stated at 904. This splendid triumph was received at home with the warmest congratulation, and celebrated with great rejoicings.

1795.—The parliament met on the 30th December of the preceding year, and the speech from the throne recommended a vigorous prosecution of the war. After the usual debates on the address, a motion was made on the 5th January for a repeal of the act suspending the *habeas corpus* act, and a warm discussion of the measure followed. This motion being negatived, a bill for continuing the suspension was moved for, and carried by a great majority. The first important measure brought before the house, was a plan for the augmentation of the navy. The number required for the service of the present year was calculated at 85,000 seamen and 15,000 marines; and to raise the deficient number expeditiously, without pressing, it was proposed that a certain proportion of men should be furnished by each merchant ship according to its tonnage, and every parish in the kingdom was to contribute a man. A loan of four millions was granted to the emperor of Austria, to enable him to carry on the war. The statement of the expenditure for this year, laid before the house on the 23d February, amounted to L.27,145,000, and the deficiencies of ways and means, estimated at L.400,000, were made up by new taxes, and an abridgement of the privilege of franking letters.

The trial of Mr Hastings, protracted for seven years, was concluded on the 23d April, by the sentence of the house of Lords, by which he was acquitted of all the charges. The expences of the trial, exceeding L.70,000, were paid by the East India company. A message from the king, delivered to the house of Commons on the 27th of the same month, recommended a suitable provision to be settled on the prince of Wales, who was married on the 8th to Caroline, daughter of the duke of Brunswick. An act was passed fixing the annual revenue of L.125,000, besides the rents of the duchy of Cornwall, estimated at L.13,000; but out of this income the sum of L.73,000 was appropriated to the discharge of his debts.

The emancipation of the Irish Roman catholics, and their restoration to the full privileges of citizens professing the protestant faith, became the subject of warm discussion in the Irish parliament; and the refusal of the English government to accede to their demands excited great discontent, which at length broke out into open rebellion. Lord Fitzwilliam, who was favourable to the measure, was removed from the government of Ireland; a disposition to riot appeared, and tumults arose, the suppression of which required military interference.

The conquest of Holland, a favourite object with the French, seemed now facilitated by the prevailing disaffection throughout the United Provinces to the house of Orange and its allies. During a severe frost in the end of December, a large French army marched over the ice of the Waal; but they were repulsed by 8000 British troops, and forced to recross the Waal with considerable loss. This success was only temporary, for their numbers being increased they effected their passage, and obliged the British forces to retire. The retreat of the British army after being attacked, and having lost their camp equipage, was most disastrous. Without the least shelter during a severe frost, and a heavy fall of snow, in the middle of January, they marched across a barren heath, while they were harrassed by the pursuing enemy and the hostility of the inhabitants. The French took possession of Utrecht and Rotterdam, and were soon after formally invited to Amsterdam, where they were received with general acclamation; the Stadtholder, deserted by all, with difficulty escaped, and, having embarked with his son in an open boat, reached Harwich on the succeeding day, and sought an asylum in England.

The annexation of Holland to the interest of France, was soon followed by a peace between the republic and Prussia; Spain, drained of her resources, also sued for peace on terms dictated by the French; and, in the month of June, a British squadron landed 3,000 men in Quiberon bay. They were chiefly composed of emigrant troops, and being attacked by the republican general in the night, the greater part were killed or taken prisoners. Among the latter was the count Sombreuil, an amiable young nobleman, who, with the bishop of Dol and many others, was sentenced to suffer death, and was shot at Vannes.

Early in this year a deep laid scheme for producing a general revolt against the British government in the French islands in the West Indies was attempted to be put in execution, by means of emissaries among the negroes and people of colour; but, after a severe struggle, it was finally defeated in Grenada, Dominica, and St Vincent. The Dutch colony of the Cape of Good Hope surrendered to the fleet and army under Sir G. Keith Elphinstone and general Craig, on the 23d of September.

Considerable discontent appeared among the populace, especially in London, excited, it was supposed, by the scarcity of provisions, the cruel practices of crimps employed in the recruiting service, the successes of the French, and the defection of the allied powers. The ministers, and the supporters of the war, became unpopular; reforming societies were full of activity; and the king, on his way to parliament, was assailed with clamorous demands for peace, and one of the glasses of his coach was broken by a bullet.

1796.—Before the close of the session of parliament in May, the discussion of the taxes which were necessary in consequence of the unusual introduction of two loans in the same session, which, together, amounted to twenty-five and a half millions, formed the most prominent feature in their proceedings.

In the important events which took place in the course of this year, Britain had no direct share. An insurrection against the new British government in Corsica broke out in October; and the garrison, deeming itself unequal to an effectual resistance, embarked in the ships in the harbour, and retired to the isle of Elba. War was declared against Great Britain by the Batavian republic in May, and by Spain in October. In the East Indies, the Dutch settlements in Ceylon, Amboyna, and Banda, submitted without resistance to the British troops, in the end of last year and the beginning of the present. Grenada, in the West Indies, was recovered from the insurgents, and St Lucia was reduced; and the Dutch settlements in Demarara and Essequibo acknowledged the same authority. A fleet of Dutchmen, consisting of three ships of the line, three frigates, and some smaller vessels, with two thousand troops on board, which had sailed from Holland for the recovery of the Cape of Good Hope, was captured by the British squadron, without opposition. A negociation for peace was entered into with the French directory, and Lord Malmesbury was sent to Paris in October on that business; but, after a great deal of discussion, his mission failed. The supply required for this year was stated at nearly twenty-eight millions. Towards the close of the year, great alarm prevailed of an invasion of some part of the coast of Britain by the French. An armament was equipped at Brest, consisting of 25 ships of the line and a number of frigates, with transports for 25,000 men. When the fleet sailed, in December, some of the largest, on leaving the harbour, were driven on the rocks, and lost. The fleet being dispersed by a violent storm, only seven ships of the line and ten others reached Bantry bay, in the south of Ireland, on the 24th of December; and as general Hoche had not arrived, the fleet, after being some days in the bay, returned to France, with the loss of two ships of the line and three frigates. The death of Catherine II. whose reign forms one of the most brilliant periods of Russian history, and the retirement of general Washington from public life, may be enumerated among the events of this year not altogether unconnected with the affairs of Britain.

1797.—Great Britain had now become a principal in the war, and the desertion of her allies compelled her to fight for her own security. Lord Malmesbury's unsuccessful negociation cast a deep gloom on the prospects of the country, and produced an unusual depression of the funds; and a strong sensation was produced by the suspension of cash payments by the bank of England, arising from the large advances of foreign subsidies. From an investigation of the affairs of the bank by a secret committee, it appeared, that a surplus property of nearly four millions beyond the amount of their debts, beside a permanent debt from government of more than eleven millions, remained. Various regulations were made on this subject; and a bill was passed to continue, for a limited time, the restriction of the issue of specie.

In the early part of the year, a splendid naval victory was achieved, and exhibited a striking example of the superior skill and bravery of British seamen. Spain had made great exertions in equipping a fleet, for the purpose of making a junction with the French squadron at Brest; and a powerful armament, composed of 27 sail of the line, six of which mounted 112 guns, and one 136 guns, but having a large proportion of landmen on board was indifferently manned, was attacked on the 14th February by admiral Jervis, whose fleet consisted of only fifteen ships of the line and some frigates, but he was well supported by brave and skilful officers and experienced seamen. Cruising off Cape St. Vincent, in Portugal, he descried the Spanish fleet, bore down upon it, and cut off one-third of the line. The attempt of the Spanish admiral to rejoin his separated ships, was defeated by commodore Nelson, and victory soon decided in favour of the British, who took four ships of the enemy, one of which carried 112 guns. As a reward for this service, the admiral was ennobled, and received the title of Earl St. Vincent, and Nelson received the honour of knighthood. The island of Trinidad, in the West Indies, was about this time reduced to the dominion of Britain; but an attack on Porto Rico was unsuccessful.

In the same month, a singular armament was fitted out at Brest, and made its appearance on the coast of England; it consisted of four vessels, three of which were large frigates, and with 1400 men on board. They entered the British channel, anchored in a bay near Fishguard in Pembrokeshire, and landed the soldiers. The alarm was given, and Lord Cowdor placed himself at the head of more than 3000 men, who were soon collected from all quarters. The invaders immediately agreed to surrender as prisoners of war, and next day laid down their arms. The purpose of this singular enterprise was never explained; many of the men were in rags, and seemed to have been just taken from prison.

A serious mutiny in the British navy excited great alarm in the nation in the early part of this year. The smallness of their pay, and of the Greenwich pensions, the unequal distribution of prize money, the severity of naval discipline, and the haughty conduct of their officers, were the chief subjects of complaint among the seamen. In February and March, anonymous petitions from several of the ships companies in the channel fleet of Lord Bridport, praying for relief, were transmitted to Lord Howe, who, on enquiry, was assured that no general discontent prevailed in that fleet; but on its return to Portsmouth, an unanimous agreement was entered into, that not an anchor should be lifted, till full redress of their grievances was obtained; and on the 15th April, when the signal for sailing was hoisted, the mutiny was declared by three cheers from the Queen Charlotte, which were answered by the rest of the fleet. Delegates were appointed from each ship's company, who held their deliberations on board the Queen Charlotte; an oath was administered to every seaman to stand firm to their purpose, the more obnoxious officers were sent on shore, but otherwise strict discipline was observed; and a petition to the Admiralty, and another to the house of Commons, stating the nature of their complaints, were presented. The board of Admiralty was removed to Portsmouth, and a negociation was entered into; but order was not restored till Lord Bridport went on board, and assured them that their grievances were redressed. A fresh mutiny broke out on the 7th May, on a suspicion among the sailors that the promises made to them would not be kept; but by the prudent interference of Lord Howe, it was fortunately quelled. On the following day, an estimate was laid before the house of Commons for the augmentation of pay to the seamen and marines of the navy, and the sum required was stated at L.436,000; and a bill introduced for this purpose was passed into a law.

But these concessions were not altogether satisfactory, for, on the 22d of May, a mutiny of a still more alarming nature broke out in the men-of-war lying at the Nore; they were afterwards joined by four ships from admiral Duncan's fleet off the coast of Holland. Delegates wese elected, and a statement of their grievances was drawn up and presented to the Admiralty, but their demands were refused; and Parker, a person of some education and determined character, declared that the seamen would keep possession of the fleet till their grievances were redressed. An offer of pardon to bring back the men to their duty being unsuccessful, it was determined by government to reduce them to subordination by force. While preparations were making for this purpose, by taking up the buoys at the mouth of the river, and erecting batteries on the banks, a proclamation, declaring the

Civil history. ships in a state of rebellion, and prohibiting all intercourse from the shore, was issued. At the same time the mutineers became disunited among themselves; ship after ship deserted their cause; and at last all the ships having submitted, Parker and the other delegates were given up. He was tried by a court-martial, capitally convicted, and executed, along with some of his associates; and this alarming state of affairs was terminated by a general pardon to the other offenders.

In July, an attack made on the town of Santa Cruz, in Teneriffe, under the command of admiral Nelson, was most disastrous. Of a thousand men who landed on the mole, nearly the whole were killed or wounded, and the commander himself lost his right arm.

The arms of the French republic were eminently successful, to whatever part of the continent they were directed; the Pope was compelled to conclude a pacification on their own terms; peace was entered into with Austria; Venice was reduced to the condition of a province of France; and the state of Genoa fell under the protection of the same power.

On the 11th of October, admiral Duncan, with 16 ships of the line, attacked the Dutch fleet, of 11 ships of the line, and four of 56 guns, between Camperdown and Egmont, on their own coast, and, after a severe engagement, obtained a complete victory, having captured eight ships of the line, two of 56 guns, and two frigates, with the admiral and vice-admiral of the fleet. The news of this brilliant success was followed with great rejoicings, and the British commander was rewarded with a peerage.

1798.—The discontents in Ireland, which had continued for some time, at last broke out into open rebellion, and a general insurrection was planned, according to which it was determined to seize the castle of Dublin, the camp near it, and the artillery, at the same time. This plot was defeated by the information of one of the conspirators. The rebels flew to arms, with 15,000 men made themselves masters of Wexford on the 30th May, were repulsed at New Ross, and their main body, posted on Vinegar Hill, was attacked by general Lake on the 21st of June, and totally routed. A similar insurrection was attempted in the north, but was soon suppressed. Lord Cornwallis, on account of his political and military talents, was appointed to the government of Ireland soon after these events, and by his moderation and prudent conduct the quiet of the country was restored. But the landing of 900 regular French troops under General Humbert, on the west coast of Ireland, in the month of August, from three French frigates, threw the country again into disorder. General Lake opposed their progress at Castlebar, but was compelled to retreat. The French, and some Irish malcontents who had joined them, crossed the Shannon, and while Lord Cornwallis was advancing with more troops, general Lake, who continued to watch the movements of the enemy, came up with their rear on the 8th September, and, after a short action, compelled them to surrender. In the following month another attempt of the French to invade Ireland was not more successful. A ship of the line, and eight frigates, with troops and ammunition on board, appeared off the north-west coast; and on the 12th October, Sir John Borlase Warren captured the former, and, three of the latter; and excepting two frigates, the whole fell into the hands of the British. Civil history.

Among the proceedings of parliament, a bill passed for increasing the assessed taxes; a plan was introduced for extinguishing part of the national debt, by allowing individuals to purchase their land tax; and, in April, a new estimate for the public supplies was proposed, and the sum required amounted to nearly twenty-eight and a half millions. A loan of fifteen millions for Great Britain, and two millions for Ireland, and some new taxes, were among the ways and means. Connected with military affairs, an enactment was made for allowing men in the supplemental militia to inlist into the regular army; and by another law, permission was given to the militia regiments to extend their services to Ireland.

The French having over-run a great part of the continent, and almost all opposition to their overgrowing power having terminated by the treaty of Campo Formio, they were eager to humble and reduce Britain to the same abject state. For this purpose troops were collected on the opposite coast, and, in allusion to its destination, it was called the Army of England, and transports were fitted out in the harbours of the channel to convey the troops to the shores of Britain. Whether all this hostile preparation was merely intended to excite alarm, or whether it had any serious object in view, the most active measures were adopted to repel the threatened invasion. The militia was increased; bodies of the regular cavalry were raised among the yeomanry; and volunteer infantry were embodied and trained throughout the kingdom. A bold attack was made on the enemy's coast in the month of May, by a number of vessels and a body of troops under the command of captain Home Popham and general Coote, for the purpose of destroying some transport-boats at Flushing, which were to be employed in the invasion. The troops landed to the eastward of Ostend, blew up the sluices of the canal, and destroyed a number of vessels; but on returning, the violence of the surf prevented them from re-embarking; they were attacked by a superior force, and compelled to surrender.

The Swiss cantons, after a spirited resistance to the aggressions and inroads of the French, were finally obliged to submit to their invaders, and the whole were formed into one republic, dependent on France. The castle of St Angelo at Rome was seized in February by a body of French troops. The pope was at first confined to the Vatican under a strong guard. Being informed that his civil power was at an end, and that his spiritual dignity only remained, he withdrew to Sienna; and Rome, for several months, became a dreadful scene of tumult, plunder, and bloodshed. An expedition, which had been long in preparation at Toulon, sailed, under the command of Bonaparte, on the 20th May; reached Malta early in June, and took possession of the place, not without suspicion of previous concert; and on the 1st of July arrived off the coast of Egypt, which was the ultimate object of its destination. A strong squadron, under the command of admiral

Nelson, was appointed to watch the motions of the French fleet; but it was not till the 1st August that he discovered it at anchor across the bay of Aboukir, near the mouth of the Nile. The French fleet, commanded by admiral Brueys, consisted of 13 ships of the line, one of which, L'Orient, carried 120 guns, and four frigates. The English fleet included an equal number of ships of the line, and one of 50 guns. The French squadron was moored in line-of-battle, and protected by shoals and batteries; but this advantageous position produced no hesitation in the prompt and gallant Nelson to decide on an immediate attack. A close engagement commenced; and before night several of the French ships had struck their colours. During the darkness, a most terrific scene was exhibited in the conflagration of the L'Orient, which was followed by a tremendous explosion, in which the French commander and his whole crew, exceeding 1000 men, perished. The action closed next morning; nine sail of the line were captured, and two more, with two frigates, were destroyed. This splendid victory was celebrated in Britain with extraordinary rejoicings, brought new honours to the hero by whom it was achieved, and spread the fame of British valour all over Europe.

1799.—At the close of the preceding year, the requisite supplies for the public expenditure were estimated at L.29,272,000. A plan of an income tax for raising a considerable part of them within the year was proposed. The discussions of this measure were continued at the commencement of the present year, and the resolutions submitted to the house were, in substance, that the augmentation of the assessed taxes should be repealed, and a duty of 10 per cent upon income substituted, to commence with incomes above L.60 a-year, but in a reduced ratio from that sum to L.200. The national income was calculated at L.102,000,000, from which a tax of ten millions was expected. A bill was brought in for this purpose, and passed into a law. The union of Great Britain with Ireland, which was finally arranged this year, was one of the most important legislative measures of the session. The French made many very important movements in the early part of this year, in Germany, Switzerland, and the north of Italy; but they met with a very efficient opposition from the celebrated Russian general Suwarof, at the head of 60,000 men; he defeated them at the battle of Novi in Italy on the 10th August, marched into Switzerland in the following month; but after a severe action with Massena, he was compelled to retreat with great loss; and after various movements, in which he discovered the talents and bravery of a great general, he was recalled; and, for the present, the powerful co-operation of Russia in the common cause terminated.

But in consequence of a concerted plan between the courts of London and Petersburgh, a descent on the Dutch coast was projected. An expedition under Sir Ralph Abercromby arrived at the Helder on the 27th, and took possession of the fort, which was abandoned by its garrison. The fleet, consisting of eight ships of the line, three of 54, and eight of 44 guns, with seven small ships and four Indiamen, surrendered without resistance; but, on the 10th September, the British forces were attacked by 25,000 French and Bavarian troops, and repulsed with considerable loss. The duke of York assumed the chief command on the 13th, and with an army of 35,000 men, of which 17,000 were Russians, a general attack, which was made on the 19th, was unsuccessful; but with an accession to his force, he renewed the attack on the 2d October, and defeated the French with severe loss. On the 6th an attempt was made to force the position to which the French had retreated, but it failed; and as the inhabitants shewed no disposition to second the efforts of their deliverers, it was determined to abandon the enterprise; a suspension of arms was proposed and agreed to, on condition that the prisoners on both sides should be given up; and as an equivalent for permission to the British to reimbark without molestation, 8000 seamen, Dutch or French, who were then prisoners in England, should be liberated. In August of this year, the Dutch colony of Surinam surrendered to the British arms.

Important transactions took place in the East Indies during this year. The restless Tippoo Sultan, jealous of the encroachments of the East India company on his power and territory, had entered into negociations with the French and with the Nizam of the Deccan in the preceding year, and had also sent an embassy to the king of Cabul, for the purpose of forming a coalition against the British. Some correspondence had taken place between him and Bonaparte when the latter arrived in Egypt, while the former had been gradually increasing his military establishment. The views of Tippoo, and his warlike preparations, were not unknown to the governor-general, who being disappointed of an amicable termination of the differences, resolved to attack the sultan in his capital. General Harris, with the native and British troops, entered the Mysore country in March. On the 30th April, Seringapatam was invested, and the cannonading having continued for several days, was stormed on the 4th May, when a dreadful conflict ensued, and Tippoo lost his kingdom and his life. His territories were divided, part was assigned to the English, part to the Nizam, and a sovereignty was restored to a descendant of the ancient rajah of Mysore, who had been dispossessed by Hyder Ally, the father of Tippoo.

1800.—In promoting his ambitious views, Bonaparte abandoned his army in Egypt, and on his return to Paris succeeded in introducing a new form of government, at the head of which he found means to place himself in the character of First Consul. One of his first acts connected with this country was, to address a letter, which he said was entirely confidential, to the king of Great Britain, for the purpose of entering into a negociation for a general peace. The sincerity of his sentiments was justly doubted at the time, and his future conduct, as well on the present as on other occasions, fully confirms the suspicion. An official answer in general terms was returned by the secretary of State, who declared that as soon as security was given by the French for the repose of Europe, his Majesty would not be slow in concerting with his allies the means of a general pacification; but as no such security appeared at present, he was resolved, in conjunction with the other powers interested, to prosecute the war with vigour. In answer to this letter, a note was returned by Talleyrand, who proposed a suspension of hostilities, and the appointment of plenipotentiaries on both sides, to hold a conference for the adjustment of the differences between the two nations. The correspondence terminated with Lord Grenville's reply.

The subjects of discussion in parliament were, the vigorous prosecution of the war; the correspondence with the French government for negociating a general peace; an enquiry into the failure of the late expedition to Holland, which was suppressed; the great increase of the national expenditure, for which the supply required was stated at the enormous sum of thirty-nine and a half millions, and for which a loan of eighteen and a half millions was part of the ways and means; and the final conclusion of the proposed union of Great Britain and Ireland. The scarcity of corn, which had risen to a higher price than had been known at any former period, and the means of alleviating the severe distress which it occasioned, became also the topics of parliamentary investigation. A bill was passed, prohibiting the sale of bread which had not been baked 24 hours, and the members of both houses resolved as much as possible to diminish the use of bread and flour in their own families. The same example was imitated by the higher ranks throughout the kingdom; but as the produce of the harvest was still deficient, parliament met early in November, and various acts were passed for continuing the restrictions upon the consumption of grain, and for encouraging importation. A bill was also passed to ascertain the population of the kingdom.

1801.—On the first of January a proclamation was issued, relative to the titles and armorial ensigns belonging to the imperial crown of Great Britain and Ireland; and to mark the era of the union with Ireland, new titles were conferred on some of the nobility of that country, and several of them were created peers of the united kingdom.

A confederacy having been formed by the northern powers, for the purpose of annulling or diminishing the naval dominion which Great Britain had arrogated to herself, an embargo was laid on all the ships in British ports belonging to these powers, and letters of marque were issued for the capture of their vessels at sea; and after some correspondence, as a measure of retaliation, a similar embargo was put on the shipping of Great Britain in the ports of Sweden and Denmark. To settle the point in dispute, a squadron of 18 ships of the line and four frigates, beside bomb-vessels and gun-boats, was dispatched to the Baltic, under the command of admiral Parker, and vice-admiral Nelson. The most vigorous preparations were made by Denmark to resist this force; the whole Danish fleet were stationed in the road of Copenhagen, and was strongly supported by floating and land batteries. But the onset, headed by Nelson, with 12 ships of the line, and all the frigates and small vessels, was irresistible. While the battle yet raged, Nelson, certain of success, and anxious to save the lives of men, sent a proposal for a truce to the prince-royal of Denmark, and landed himself to settle the terms of conciliation. At this time 17 sail of the Danish line were either sunk, burnt, or taken.

The death of the emperor Paul, whose incoherent conduct indicated some degree of mental derangement, and rendered him unfit to manage the reins of government, gave a new aspect to the state of affairs in the north. His successor, Alexander, immediately liberated all the British seamen belonging to the ships sequestrated by his father; and after negociations between the courts of London and Petersburgh, all disputes were adjusted, and Sweden and Denmark acceded to the same terms.

An armament, destined for the recovery of Egypt, was prepared in the end of the preceding year, and being placed under the command of Sir Ralph Abercromby, arrived at Aboukir on the 2d March; experienced a vigorous resistance, and suffered a considerable loss when they landed on the 8th; and having advanced towards Alexandria, they encountered the French on the 13th in a smart and indecisive action. Before daylight on the 21st, an obstinate conflict took place, which terminated in the defeat of the French; but the loss of the British was considerable, and the commander himself was mortally wounded. General Hutchinson, who succeeded to the command, was reinforced by a body of Turks, the French retreated to Cairo, and the united army advancing, agreed to a capitulation on the 27th June, on condition that the French troops, with their arms and effects, should be conveyed to the French ports in the Mediterranean. Menou, the other French general, who had remained at Alexandria, refused to accept of the capitulation, and defended himself till the 27th August, when he offered to submit, and received the same terms; and thus Egypt was delivered from the attempt to reduce it to the state of a French province.

The resignation of Mr Pitt formed a prominent feature in the political administration of the country. His retirement from office was ascribed to his inability of redeeming a pledge which he had given to remove the restrictions from the Roman catholics of Ireland, in consequence of the insuperable objection of the measure being contrary to the king's coronation oath. But before he resigned his office, he submitted to the house his financial plans. The necessary supplies were stated at more than thirty-five millions and a half; to defray which, some new taxes, and a loan of twenty-five and a half millions, were proposed. A new ministry was formed, whose measures were first directed to secure the internal tranquillity of the country. The disturbances in Ireland required the renewal of the act for the suppression of rebellion in that country; and the proceedings of societies of disaffected persons in Britain, occasioned a revival of the act for preventing seditious meetings, while the suspension of the *habeas corpus* act was continued in both countries. During this session of parliament an act was passed, declaring clergymen ineligible to a seat in the house of Commons. This enactment had an immediate reference to the election of the celebrated Horne Tooke as member for Old Sarum.

To excite alarm in Britain, or for the more serious purpose of actual invasion, the First Consul formed encampments, which were occupied by chosen troops, on the opposite coasts of France and Flanders, and the combined French and Spanish fleet was collected in the harbour of Brest. These hostile preparations were not overlooked by Great Britain; a great military array was provided; the volunteer cavalry, and infantry frequently assembled for exercise, and was kept ready for immediate service; and the naval force of the empire blockaded the principal ports of the enemy, and kept the closest watch on all his movements.

Some naval actions, with various success, were fought this season. Two English frigates, and a man-of-war of 74 guns, were captured by Gantheaume's squadron in the Mediterranean; and the French squadron under admiral Linois, lying at anchor off Algeziras, was attacked by admiral Saumarez, one of whose ships of 74 guns, getting on shore near a battery, suffered so much by the enemies fire, that she was obliged to strike her colours; but in a succeeding action the week following, with the same French ships, reinforced by five Spanish ships of the line, admiral Saumarez captured one ship of 74 guns, while two of the Spanish ships, of 112 guns each, took fire and blew up. In the month of August, Lord Nelson, with a flotilla of gun-boats and other armed vessels, engaged in an enterprise against the harbour of Boulogne, with the intention of destroying the small craft intended for the invasion of England. The French were so well provided with every means of defence, that the daring courage and perseverance of British seamen, who suffered a considerable loss in killed and wounded, made little impression.

The preliminaries of peace between Great Britain and France were signed on the 1st October, and excited sentiments of satisfaction among the people of both countries; and in the beginning of the succeeding month Marquis Cornwallis was appointed ambassador plenipotentiary, for the purpose of negociating the definitive peace. Similar treaties between France and the Ottoman Porte, and France and Russia, soon followed.

1802.—The definitive treaty of peace between France, Spain, and the Batavian republic on the one part, and Great Britain on the other, was signed at Amiens on the 27th of March. But the First Consul of France, previously to its signature, had been appointed president of the Cisalpine republic, which now became an appendage of France, while Louisiana, the isle of Elba, and the duchy of Parma, by a private treaty with Spain, were annexed to the same power. The claim of the Prince of Wales to the arrears from the revenue of the duchy of Cornwall, which, after discussion, was thrown out; the financial arrangements, in which it was proposed to abolish the income tax, and to fund the sum with which it was charged, amounting nearly to fifty-six and a half millions, making the whole sum to be funded nearly ninety-eight millions, the interest of which, exceeding three millions, to be provided for by new taxes, and with a loan of twenty-five millions, which was also proposed; the national debt, which was estimated at five hundred millions; and very ample discussions on the terms of the treaty of peace, formed the chief topics for the consideration of parliament.

A conspiracy against the government was detected towards the close of the year. Colonel Despard, who had distinguished himself in a military capacity, formed a society composed of soldiers and some of the lower class of citizens, with the professed object of reform and extension of their liberty. He and six of his accomplices were tried, found guilty, and executed for high treason.

1803.—The aspect of affairs on the continent and the military preparations which were carrying on in the ports of France and Holland, were brought before parliament, by a message from the king, in the month of March; a resolution was passed, and soon after the militia was called out; and it was announced in May that the British ambassador, in consequence of the failure of the negociation, was recalled from France. War was at last declared, and great preparations were made for its vigorous prosecution. A most outrageous violation of the laws of hospitality was committed by the French government, in seizing all persons between eighteen and sixty years of age belonging to this country, who were then in France, and declaring them to be prisoners of war; a measure which was attended by most calamitous consequences, both to individuals and families; and some of those who fell under this misfortune remained in captivity during the war. The French were prompt and vigorous in their operations; they took possession of all the strong posts of the kingdom of Naples lying on the Adriatic; seized Hanover, and thus obtained the command of the navigation of the Elbe and Weser, from which British commerce was excluded; and, by extraordinary exertions, collected a large army and an immense flotilla at Boulogne, for the invasion of England. But the spirit of resistance to the threatened attacks of the enemy, which pervaded the country, increased the number of volunteer associations to such an extent, that in a short time not fewer than 300,000 men were trained to arms and ready for service.

In the West Indies, St Lucia, after the fort of Morne Fortunée was stormed, submitted to the British troops in May. Tobago surrendered, without resistance, to the same force; and the Dutch colonies of Demerara, Essequibo, and Berbice, were reduced in September. In the East Indies a very active warfare was carried on by the British, in alliance with the Mahratta sovereign of Poonah and with the nizam of the Deccan, against the Mahratta chiefs Scindia Holkar and the rajah of Berar; and the result of the military operations, which were conducted by general Wellesley, was the destruction of a powerful confederacy against the British, the annihilation of the French interest in India, and an extension of the British territory.

In the month of July, an insurrection broke out in Ireland, which, for a short time, excited considerable alarm, and which had in view the subversion of the government. The leader of this plot had collected a few arms, which were put into the hands of a desperate mob, for the hopeless purpose of seizing the castle of Dublin. A crowd of country people from the county of Kildare entered the capital, and, assembling in a tumultuous manner, were furnished with pikes and fire-arms; and having met with no opposition while they advanced through the principal streets, they were guilty of several atrocities; and at last meeting with Lord Kilwarden and his nephew in a carriage, they dragged them from it, and barbarously put them to death on the spot. But so feeble and ill-planned was the insurrection, that they were dispersed by 120 soldiers; and some of the leaders being taken, they were tried for high treason, convicted, and executed.

1804.—The mental disorder of the king appeared for a short time at the beginning of this year. Parliament was much occupied in consolidating and explaining the laws respecting volunteers; and a bill was passed for allowing the Irish militia to extend their services to Great Britain. A change of ministry took place in May; and Mr Pitt resumed his place of first lord of the Treasury and chancellor of the Exchequer.

Among the naval operations of this year, the spirited defence made by captain Dance, with a fleet of 15 Indiamen, 12 country ships, and a Portuguese Indiaman, against the French admiral Linois, with the Marengo of 80 guns, and some frigates, stands conspicuous. The French fleet were repulsed without making a single prize, and were actually pursued by the victorious merchantmen. The Dutch settlement of Surinam was reduced under the authority of Great Britain. In the month of October, a number of vessels, of a particular construction, and containing explosive materials, were sent in among the enemies small craft moored on the outside of Boulogne pier, but the effect produced was very inconsiderable.

The capture of three large Spanish frigates, loaded with treasure from the New World, was a most successful event. On the 5th October, captain Moore, with the Indefatigable and three other frigates, which had been dispatched for that service, and was cruizing off Cadiz, descried four large Spanish frigates steering for that port. The Spanish admiral being informed by captain Moore that he had positive orders to detain his squadron, returned no satisfactory answer. A close engagement commenced, and it had not continued more than ten minutes, when the Spanish admiral's second, La Mercedes, blew up with a dreadful explosion, and, with the exception of forty men, all on board perished in this terrible catastrophe, which, beside the melancholy loss of so many lives in an instant, was accompanied by an incident of a peculiarly afflictive nature: A native of America and his whole family, consisting of his wife, five sons, and four daughters, were passengers in the ship which blew up; the father and one of the sons had gone on board another ship before the action; and it is easier to conceive than express their anguish of heart, when they were thus doomed to see themselves in a moment deprived of all that was near and dear to them on earth. This act of aggression, without a previous declaration of war, was censured by some, while the capture was approved by others, on the ground that the rich treasure was destined for the service of the French, the avowed enemies of Great Britain.

With scarcely any thing short of the power of an absolute sovereign, the ambition of the First Consul of France now aspired even to the titles of royalty. After the preliminary forms, which met with little difficulty, a decree was framed and passed into a law, with the single dissenting voice of Carnot, by which the rank and title of Emperor of the French, were conferred on Napoleon Bonaparte, with hereditary succession of the same in his family; and the grand ceremony of the coronation of the emperor and empress of France, took place at Paris in November, with extraordinary magnificence, to which the presence of the pope, who was called from Rome to place the crown on his head, not a little contributed. Thus, many of the same individuals, who had solemnly sworn to maintain the inviolability of the republic, after the lapse of less than ten years, were called upon to swear obedience to the constitutions of the empire, and fidelity to the emperor.

In the course of this year, a pestilential disease broke out in the garrison of Gibraltar, and carried off many of the inhabitants and troops; and in December, the court of Spain published a declaration of war against Great Britain, alleging various acts of hostility, and particularly the attack and capture of the frigates.

1805.—The unsettled state of Ireland, and the existence of a committee of united Irishmen in Paris, required the suspension of the *habeas corpus* act in that country, which, after a keen debate on the subject, was passed. The rupture with Spain formed another topic of warm discussion in both houses of parliament. The charge of supplies for Great Britain and Ireland for this year, was stated at more than forty-four and a half millions; and among the ways and means, were a loan of twenty millions for England, and two and a half millions for Ireland, and several new taxes. In the month of April, a charge was brought against Lord Melville, first lord of the admiralty, of applying the public money to other uses than those of the naval department, and of conniving and participating in a system of peculation which had been practised in the office of pay-master of the navy; and after various proceedings in the house of Commons, his lordship, at his own request, acknowledged at the bar, that he had appropriated the public money to other public purposes, but without any benefit to himself, and without participating in the profits of others; and, at the same time, confessed that he had applied the sum of L.10,000, in a way which he could not reveal, consistently with private honour or public duty. An impeachment followed, and after his trial before the lords in Westminster hall, in the early part of the succeeding year, he was acquitted of all the charges.

The French emperor addressed a letter to the king of Great Britain, in which, probably with his usual sincerity, he expresses himself desirous of entering into pacific negociations with this country. The reply, which was not satisfactory, was published in France with comments, endeavouring to shew the determined hostility of the British court; and, at the same time, the most active preparations were made for the invasion of England. The flotilla at Boulogne was increased, and not fewer than 100,000 well disciplined troops, under the command of able generals, were collected in its vicinity.

Civil history.

Confederacy against France.—The boundless ambition and extensive influence of the French emperor, and the territorial possessions which he had acquired, or were subjected to his controul, naturally alarmed the other states of Europe. He had now assumed, at the pretended request of the States, the title and authority of king of Italy, and annexed the Ligurian republic to the French empire; and the proceedings of the Batavian republic afforded ample proof of his influence in framing their new constitution. The courts of London and Petersburgh, accordingly, entered into negociations for the purpose of adopting measures to resist the encroachments of the French government, and to secure the independence of the allied states; and, after a communication with France proposing a general pacification, Sweden and Austria joined the alliance.

Attack upon Austria.—Bonaparte, with his usual promptitude, prepared to attack Austria, and having broken up the greater part of his camp at Boulogne, and reinforced his army from other quarters, he proceeded by forced marches to meet the Austrians on the banks of the Danube; and such were the rapidity of his progress, and the success of his arms, that the strong post of Ulm surrendered, and the whole of the Austrian troops laid down their arms. Great alarm now prevailed for the safety of the capital; and the emperor of Germany having retired with his court from Vienna, the French entered it on the 13th November. The French were not less successful in Italy.

Battle of Austerlitz.—The main army of the allies, was composed of 50,000 Russians, with the emperor Alexander at their head, and of 25,000 Austrians, consisting chiefly of new levies. The amount of the French army was nearly 80,000 men, in the best state of discipline, and full of confidence from former successes. The contending armies met near the village of Austerlitz on the 2d of December, and fought a sanguinary battle, which is noted in history by that name, or distinguished by the name of the battle of the Three Emperors, from the sovereigns of Austria, Russia, and France being present.

Battle of Trafalgar.—The French fleet having eluded the vigilance of Lord Nelson, sailed from Cadiz with a body of troops on board for the West Indies. The British admiral, informed of their destination, pursued the enemy with an inferior force, and reached Barbadoes on the 4th June. But the French admiral declined to risk an engagement, and returned to Europe; Nelson pursued, but was not fortunate in coming up with the enemy. In a partial engagement with Sir Robert Calder, two ships of the line were taken from the French; Lord Nelson returned to England, sailed again from Portsmouth in September, and having taken the command of the fleet under admiral Collingwood, lying off Cadiz, he took measures for watching the motions of the enemy. The combined fleet, consisting of 33 sail of the line, of which 18 were French and 15 Spanish, sailed from Cadiz on the 19th October, steered towards the straits of Gibraltar, and were followed by the British fleet, composed of 27 ships of the line, which came up with them on the 21st, off Cape Trafalgar. Lord Nelson, with his usual skill, boldness, and promptitude, bore down in a double column on the enemies fleet, which was drawn up in the form of a crescent, brought them to close action, which was continued for four hours, and terminated in the capture of 19 sail of the combined fleet, with the French commander-in-chief and two Spanish admirals. The loss of the victors in this severe conflict exceeded 1500 men in killed and wounded; but the joy which the splendour of the triumph diffused over Britain, was not unmingled with the sincerest regret at the fall of the naval hero who had planned and executed this unparalleled enterprise.

1806.—*Death of Mr Pitt, and new ministry.*—The death of Mr Pitt on the 23d of January, two days after the meeting of parliament, was the first object of its attention. It was moved and agreed to in the house of Commons, that his remains should be honoured with a public funeral, a monument should be erected to his memory, and his debts, amounting to L.40,000, should be discharged by the nation. This event was immediately followed by the formation of a new ministry, with the arrangement of which Lord Grenville was entrusted. Lord Erskine was nominated lord Chancellor, Earl Fitzwilliam president of the Council, Viscount Sidmouth lord Privy-seal, Lord Grenville first lord of the Treasury, Lord Howick first lord of the Admiralty, Lord Moira master-general of the Ordnance, Earl Spencer, Mr Fox, and Mr Windham secretaries of State, Lord Henry Petty chancellor of the Exchequer, and Lord Ellenborough lord Chief-justice.

Parliamentary proceedings.—The first measure brought forward by the new ministry was a change in the mode of recruiting the army, the prominent part of which was, that the enlistment should continue for a limited term of years. Another alteration in the military system was to train a certain number of persons, not exceeding 200,000, out of those liable to serve in the militia; and some regulations were also made relative to the militia itself. The budget, which was opened on the 28th March, exhibited the unredeemed national debt of Great Britain and Ireland to be nearly L.556,000,000, and the redeemed debt to be L.127,000,000. The requisite supplies were stated at L.43,618,672; and among the proposed ways and means were a loan of eighteen millions, and war taxes to the amount of nineteen and a half millions. The property tax was at this time advanced from six and a half to ten per cent. The free interchange of every kind of grain between Great Britain and Ireland, without bounty or duty, was an important measure of domestic policy, which passed into a law; and the abolition of the slave trade, to the satisfaction of every friend of humanity, was finally effected during this session.

Affairs of France.—The power of Bonaparte still continued to extend itself. The territory of Naples was occupied by a French army under the command of Joseph Bonaparte, who was proclaimed king on the 30th March; and the splendid exploit of Sir John Stuart, on the plains of Maida, where he routed the French at the point of the bayonet, was only followed by an insurrection of the Calabrian peasantry, but without any other permanent change. An attempt at pacification between Britain and France, in which Lord Lauderdale was delegated to Paris, failed,—while new plans were in agitation for the aggrandisement of France, and in particular the famous confederacy of the Rhine, as it was called, of which Napoleon declared himself Protector. The battle of Jena, so fatal to Prussia, was fought on the 14th October, and gave Bonaparte the possession of the greater part of the Prussian territory. Hamburgh was entered on the 19th November; an order for the sequestration of all kinds of English produce and manufactures, and for the arrest of English merchants, was immediately issued; and for the purpose of excluding all British commerce from the continent, the most severe decrees were enacted and rigorously executed. The Batavian republic, or the seven united provinces of Holland, were formed into a monarchy, and Bonaparte's brother, Louis, was destined to receive the crown.

Naval exploits.—Admiral Duckworth engaged a French squadron off St Domingo, and captured three ships of the line. Sir John Borlase Warren fell in with admiral Linois on his return from India to France, and took the Marengo of 80 guns, and the Belle Poule of 40 guns; and Sir S. Hood captured four out of five large frigates which were destined for the West Indies with troops.

Cape of Good Hope.—The Dutch settlement of the cape of Good Hope was this year reduced under the dominion of Britain, by an armament under the command of Sir David Baird and Sir Home Popham; and this valuable colony has since continued subject to Great Britain.

Death of Mr Fox.—Mr Fox died on the 7th of September, and his death, as might be expected, was followed by some changes in the ministry; Lord Howick was his successor as secretary for foreign affairs. Parliament having been dissolved, the new parliament met on the 19th December, and the vacillating conduct of Prussia was the subject of discussion in the debates on the usual addresses.

1807.—When parliament re-assembled, a discussion took place on the late negociations for peace with France. In the financial statement laid before the house of Commons, the requisite supplies amounted to L.40,527,000 for Great Britain, and L.5,314,000 for Ireland. A motion was made in the house of Commons by Lord Howick, for leave to bring in a bill for securing to all his majesty's subjects the privilege of serving in the army or navy, upon their taking an oath prescribed by act of parliament; and for leaving to them, as far as convenience would admit, the free exercise of their respective religions. But the progress of the bill was interrupted by a change in the administration on the 25th March, and on the day following the late minister stated the principles on which they were friendly to the bill for granting relief to the catholics and other dissenters; and in this disposition, which was at variance with the sentiments of the king, the change alluded to had originated.

New Ministry.—The principal places in the new administration were occupied by the duke of Portland, as first lord of the Treasury; Mr Canning, secretary for Foreign Affairs; Lord Hawkesbury for the Home Department; Lord Castlereagh for War and colonies; Lord Eldon, Lord-chancellor; Mr Perceval, chancellor of the Exchequer; earl of Chatham, master-general of the Ordnance; earl of Westmoreland, lord Privy-seal, Earl Camden, president of the Council; and Lord Mulgrave, first lord of the Admiralty. Parliament was dissolved; and when the new parliament assembled on the 22d June, the issue of the debates on the topics which led to that measure shewed that the present administration had a decided majority in the house. The new military plan, by which the regular army was to be augmented from the militia, was introduced aud passed into a law, and some regulations with regard to the internal affairs of Ireland were found necessary, and passed into laws.

Expedition against Copenhagen.—A powerful expedition was fitted out against Copenhagen this summer, for the purpose of obtaining possession of the Danish fleet, to prevent its falling into the hands of Bonaparte. After an attempt at negociation failed, the city was bombarded, and set on fire in several places. To prevent its general destruction, an armistice was proposed, and, according to the terms of capitulation which followed, the fleet was delivered up and conveyed to England.

Among the military operations of this year, the acquisition of the island of Heligoland, which surrendered by capitulation in September, was of great importance to this country as a commercial depot, when every port in the north seas, those of Sweden excepted, was shut against British trade.

Affairs of Spain and Portugal.—Some dissentions having taken place between the king of Spain and his son, the prince of Asturias, fomented it was supposed by Bonaparte, a treaty was entered into between Spain and France, the object of which was a partition of the kingdom of Portugal, and by a secret convention French troops were to be admitted into Spain. Bonaparte demanded of the court of Portugal to shut the ports of that country against England, and, in case of refusal, threatened them with war, for which he immediately prepared. A French army entered Portugal, and on the 29th November the prince, with all the royal family, sailed from the Tagus with his fleet of eight sail of the line and four frigates, and proceeded to Rio Janeiro, accompanied by four English men-of-war. The fleet had not left the river, when a combined army of French and Spaniards appeared in sight of Lisbon.

1808.—When Parliament met in the end of January, the expedition to Denmark became the leading topic of debate in both houses; and considerable discussions also took place concerning the orders in council which had been issued subsequently to Bonaparte's decree of blockade. The annual budget was brought before the house in April, and the amount of the supplies was stated at L.43,000,000 for England, and L.5,700,000 for Ireland. The produce of the war taxes was estimated at L.20,000,000, and among the ways and means were a loan of L.8,000,000, and additional taxes to the amount of more than L.300,000; bills for establishing a local militia of 200,000 men, to be trained for 28 days annually; for the melioration of the criminal law in England, by decreasing the number of capital punishments; for the better administration of justice in Scotland, by dividing the Court of Session into two chambers; and for prohibiting the distillation of spirits from corn or grain for a limited time,—were passed into laws.

Affairs of Spain and Portugal.—The affairs of Spain began now to assume a serious aspect. The dissensions of the royal family terminated in the abdication of the king, the nomination of his son to the throne, the seizure of the whole family by Bonaparte, and while they were his prisoners at Bayonne, the renunciation of the Spanish crown in favour of his own family, and the elevation of Joseph Bonaparte to the throne. But the nation did not calmly submit to this humiliating reverse; the people, indignant at this unparallelled usurpation, rose in a mass, and sent deputies to London soliciting the aid of Britain; peace with Spain was proclaimed; the Spanish prisoners in this country were liberated and sent home; the patriots were liberally furnished with warlike stores; and a league, offensive and defensive, was concluded between Spain and Portugal. The Spanish patriots having obtained possession of Cadiz, forced a fleet of five ships of the line, with 4000 seamen, to surrender; they were successful also in other provinces; and the new king, doubtful of his security in the capital, evacuated Madrid. The British forces had landed in Portugal to support the cause of independence in that quarter; and, under Sir Arthur Wellesley, had twice defeated the French, first at Roleia, and then at Vimiera; but the command having devolved on Sir Hew Dalrymple, a convention was agreed to, by which the French, without being considered prisoners of war, were to be conveyed home at the expence of Britain, and with all their arms, equipments, and private property. The intelligence of this convention was received at home with great dissatisfaction, because the advantages of the victory at Vimiera, which might have been followed by an unconditional surrender, were entirely sacrificed. Towards the close of the year, the French having defeated the patriots, advanced upon Madrid, and soon became masters of that capital, while Sir John Moore, with a body of British troops, entered Spain for its relief; but the adverse state of affairs caused an alteration in his plans, and compelled him to the disastrous retreat which terminated in his death at Corunna, while he bravely withstood, with his exhausted army, the impetuous attack of the pursuing enemy.

Sweden.—War being declared against Sweden, by Russia, Prussia, and Denmark, a British squadron with a body of forces was dispatched to her assistance against the combined powers; but the measures of the king, dictated more by the impulse of passion than by rational policy, were incompatible with the instructions of the British commander, and thus rendered the proffered aid of no avail.

1809.—The early part of this session of parliament was much occupied with charges of corruption against the duke of York in his military capacity as commander-in-chief. After a long examination of evidence, a motion was made, and carried by a considerable majority, that personal corruption and connivance at corruption imputed to the duke are wholly without foundation, and the business terminated by a formal communication to the house, that his royal highness had resigned the command of the army. The business of East India appointments, and of the employment of influence in returning members of parliament, was also the subject of investigation, and a bill was passed to prevent bribery and corruption in procuring or obtaining seats in parliament. This year the amount of supplies for Great Britain and Ireland was stated at L 53,862,000; and, among the ways and means, were a loan of eleven millions for Great Britain, and nineteen millions of war taxes. On no former occasion was the loan contracted for on such favourable terms for the public, arising, it was supposed, from the depressed state of foreign trade.

Affairs of Portugal and Spain.—Sir Arthur Wellesley, with a reinforcement of troops, having landed at Lisbon in April, proceeded to take the command of the British army at Coimbra, and advanced against Oporto, which was abandoned by the French. The defeat of the Spaniards in Estremadura, rendered it expedient for the British commander to turn to the southward; and being joined by some Spanish troops, he proceeded along the valley of the Tagus, against the French, who were posted near Talavera; and on the 27th of July a severe action commenced, and terminated in a complete repulse of the French, but the junction of several bodies of the enemy obliged Sir Arthur Wellesley to retreat; in other parts of Spain the French were generally successful.

Germany.—A new rupture with Austria required the presence of Bonaparte in Germany; war was declared against him by the emperor Francis, and such was the rapidity of their hostile preparations, that the battles of Abensberg and Eckmuhl were fought on the 20th and 22d of the same month. Another sanguinary action took place at the village of Asperne, where the French emperor met with a very severe check. But the decisive battle of Wagram was fatal to the Austrians, and led to an armistice and peace, which was signed at Vienna the 15th of October.

Walcheren expedition.—For the purpose of gaining possession of the islands commanding the entrance of the Scheldt, and especially the port of Flushing, and to destroy the French men-of-war, dock-yards, and arsenals in that river, great preparations were made in equipping a powerful armament, and the expedition, under the command of the earl of Chatham, sailed in the end of July. Flushing, after a tremendous bombardment, surrendered; but Antwerp was too strongly fortified and defended to give any hope of success against that place; and as the islands of Walcheren and South Beveland were not the ultimate objects of attack, and great sickness prevailed among the troops, Lord Chatham, with the greatest part of his army departed for England on the 14th of September. Part of the troops was left to preserve a commercial intercourse with Holland; but the dreadful mortality from the fever continuing unabated, the island was finally evacuated on the 23d of December; and thus terminated this ill-fated and ill-planned expedition.

Among the military transactions of the present year may be enumerated, the destruction of a number of French ships near Rochelle, by a squadron under Lord Gambier and Lord Cochrane; the capture of Martinique, and the surrender of the French colony of Cayenne, and of the French settlement of Senegal on the coast of Africa; and the reduction of the Seven Islands by a British force, and the restoration of that republic.

The 25th of October of this year, which was the 50th anniversary of the king's accession to the throne, was celebrated throughout the United Kingdom as a jubilee, and was distinguished by every demonstration of marked respect for his virtues, and loyal attachment to his person.

1810.—The late events in Spain, and the unsuccessful expedition to the Scheldt, formed the chief topics of debate on the address to the king's speech on the opening of parliament. These questions which were keenly debated within doors, were the subjects of comment without, and led first to the imprisonment of J. Gale Jones in Newgate, for a violation of the privileges of the house of Commons, and, finally, the commitment of Sir Francis Burdett to the Tower, on which occasion, in consequence of the resistance offered to the execution of the warrant, a mob collected and committed many outrages, and being fired at by the military, some lives were lost, and several persons were wounded.

The supplies voted this year, were stated at L.50,566,000, for Great Britain and Ireland; and among the ways and means were a loan of eight millions, and the war taxes estimated at 19½ millions, without any new taxes.

Spain and Portugal.—Early in this year, the progress of the French arms had been so successful in Spain, that they had the command of a line of posts from the Mediterranean to the bay of Biscay. But, their great object was the possession of Portugal, in which they were opposed by the consummate address of Lord Wellington, who determined to act on the defensive, and not to risk a general engagement with a force so much superior to his own army. He therefore retreated towards Lisbon, gave Massena, the commander of the French, a severe check on the heights of Buzaco, and at last retired to the strong lines of Torres Vedras.

The cortes of Spain, composed of the national representatives, assembled at Cadiz in September, acknowledged Ferdinand VII. passed an act for a new levy of 150,000 men, and for the subsistence and equipment of the existing armies, and decreed the liberty of the press, while they resolved to publish their own proceedings in regular journals.

The principal events connected with the aggrandizement of France this year, were the marriage of the emperor with the daughter of the emperor of Germany, and the annexation of Holland to his overgrown territory.

Among the military operations, may be noticed Guadaloupe, the last island belonging to the French in the West Indies, which submitted to a British force; and in the East Indies the isles of Bourbon and France, the Dutch settlement of Amboyna, and the whole island of Banda, surrendered to the same power.

1811.—The king's illness, which had returned at the close of the year, demanded the attention of parliament in settling the regency. The discussions on this subject finally terminated in February of the present year, and the prince of Wales, under certain restrictions, entered upon the exercise of the royal prerogative, while the management of the king's household, and the care of his person were intrusted to the queen, assisted by a council. The affairs of the Irish catholics were again brought before parliament, and the failure of their petition was the occasion of numerous meetings and much discontent. The state of the bullion and currency of the kingdom led to a very long and elaborate discussion on those subjects of political economy. In the financial arrangements which were proposed in May, the amount of supplies for Great Britain and Ireland was stated at L.56,000,000; and among the ways and means were reckoned a loan of nearly twelve and a half millions, and the war taxes at twenty millions. The return of the duke of York to the office of commander in chief was also noticed in parliament, and a motion for disapproving of that measure was lost by a great majority. During this session a clause was introduced in the mutiny bill, giving a power to courts-martial of inflicting the punishment of imprisonment in the place of corporal punishment; and a bill passed into a law for an interchange of the militia of Great Britain and Ireland.

Affairs of Portugal and Spain.—At the close of last year, the two great armies of the combined forces of British and Portuguese, under Lord Wellington, and of the French under marshal Massena, were in strong posts in the vicinity of Lisbon; but the latter, aware that he could make no impression on the admirable position of his antagonist, and being at a distance from all resources for the supply of his troops, deemed it prudent to consult the safety of his army by a timely retreat; and on the night of the 5th March he quitted his strong camp at Santarem, leaving behind or destroying some of his heavy artillery. He was closely pursued by Lord Wellington; and, after much skirmishing and some sharp actions, he entered Spain, and continued his retreat. After various other military operations, the battle of Albuera was fought; and, after a very severe action, in which the British sustained great loss, the enemy was completely repulsed, and retreated. A splendid action took place in the vicinity of Cadiz, where general Graham, with a British force, routed the French with great slaughter on the heights of Barrosa. But the siege of Tarragona was the principal event of the summer campaign. On the 28th June, a practicable breach being made, the assailants rushed in and almost instantly carried the place, when a scene of undescribable horror was exhibited in every kind of outrage and barbarous cruelty committed by the French on the garrison and inhabitants. In the French general's account of these sanguinary proceedings, it is related that 4000 were killed in the city; of 10,000 or 12,000 endeavouring to escape over the walls, 1000 were sabred or drowned, and 10,000 were made prisoners. In the defence of this place, the besieged received some succours from the British fleet.

East-Indies.—Batavia, the capital of the Dutch East India settlements, with the island of Java, in which it is situated, became a splendid acquisition to the British possessions in that region. The armament which was destined for this conquest, and which was accompanied by Lord Minto, the governor-general, landed on the 5th August; and, after a strong resistance, the city and the whole island submitted to the British power.

1812.—When the parliament met in the beginning of January, the regulation of some matters relative to his majesty's household, and for defraying the expences of the Prince Regent in assuming the personal exercise of the royal authority, as well as a provision for the princesses, occupied its attention. The state of Ireland, particularly with regard to the Roman catholics, was the subject of keen debates; and a bill passed to suppress the disturbances which had continued for some time in the town and county of Nottingham, and to render the crime of frame-breaking, which was then systematically perpetrated, a capital offence.

Death of Mr Perceval.—The tragical fate of Mr Perceval, who was shot by a person of the name of Bellingham, as he entered the lobby of the house of Commons, about five in the evening of the 11th May, excited, as might be expected, great consternation in both houses; and, it was at first supposed, would produce some material change in administration. Much correspondence, and a good deal of discussion prevailed in both houses with regard to the expected change. In the end, Lord Liverpool was appointed first lord of the Treasury, Lord Sidmouth home secretary of State, and Mr Vansittart chancellor of the Exchequer.

The financial plans for the year were laid before the house in June, and the amount of supplies for Great Britain and Ireland was stated at more than L.58,000,000; and of the ways and means, the war taxes were estimated at nearly twenty and a half millions; a loan by subscribers of exchequer bills funded of more than six and a half millions; another loan of upwards of fifteen and a half millions; and a vote of credit of three millions. New taxes to the amount of nearly two millions were proposed.

Spain.—The war in Spain was attended with various success. Ciudad Rodrigo was invested by Lord Wellington, and taken by storm. Badajos shared the same fate; and his Lordship advanced upon the French army under marshal Marmont, and brought him to action at Salamanca, where the French were totally discomfited with prodigious loss. After various movements, Lord Wellington obliged King Joseph to quit the capital; and with two divisions of the army he entered Madrid in the beginning of August. After the battle of Salamanca, the French deserted the blockade of Cadiz, and left behind them a numerous artillery and a great quantity of stores. To watch the motions of the French army, Lord Wellington left Madrid on the 1st September; and, after an unsuccessful attack on a fortified post near Burgos, he retreated to the Douro; and, towards the close of the year, established his head-quarters on the Portuguese frontier.

Russia.—The north of Europe beheld one of the most numerous and powerful armies collected from all the territories under the dominion and influence of Bonaparte, and destined to force the submission of Russia to his boundless ambition, by the actual possession of its ancient capital. The plan of defence adopted by the Russians was, to retreat gradually before their invaders, and to make resistance only in favourable positions, where it might be effectual. The first vigorous opposition was made at the city of Smolensko; but the most sanguinary conflict took place near the village of Moskwa, where the Russian main army, having taken a strong position, were attacked on the 7th September; and the whole army, on each side, of 120 or 130,000 men, was engaged from morning to night. Each party claimed the victory; but the French entered Moscow on the 14th of the month, and were disappointed in the extreme at the destruction of part of the city by fire. The want of all supplies, from which they were cut off by the active vigilance of the Russians, rendered it a very insecure place for winter-quarters; and on the 19th October, the French emperor quitted Moscow, and when a Russian winter had set in, with deep snow, commenced one of the most disastrous retreats recorded in history. It ended in the total destruction of this mighty army. According to the Russian accounts, the losses of the French by capture up to the 26th December, were, 41 generals, 1298 officers, 167,000 non-commissioned and privates, and 1121 pieces of cannon.

America.—The differences with America broke out this year into open warfare; and as the American government had obviously in view the conquest of Canada, hostilities commenced in that quarter; and the American general, who had entered the province of Upper Canada, after various movements, surrendered to an inferior British force; and in another attack, another American general, with 900 men, surrendered himself prisoner on the field.

1813.—The attention of parliament, on its meeting after the recess, was occupied with discussions on the war with America; the claims of the Roman catholics; the affairs of India; and the financial arrangements, in which the requisite supplies of the year were stated at a sum exceeding L.72,000,000 for Great Britain and Ireland; and of the ways and means were, war taxes L.21,000,000, a loan of L.21,000,000, and a vote of credit for L.26,000,000.

Affairs of Spain.—Lord Wellington having received reinforcements from England, moved from his quarters in May, marched to Salamanca, and pursued the French, who retreated before him till they reached Vittoria, where they took up a strong position. A vigorous attack was made by the combined army, which terminated in the total discomfiture of the French, under the command of king Joseph and marshal Jourdan, and with the loss of their artillery and baggage. After various successes, and after the fall of the strong castle of St Sebastian, Lord Wellington pushed forward; and, towards the close of the year, obtained a firm footing on the French territory.

Affairs of France.—The advance of the Russian army, under the command of the emperor, on the confederated territories attached to France, and the defection of Prussia from his interests, roused Bonaparte to make a powerful effort to recover his lost ground. By a decree of the senate, 350,000 men were placed at his disposal. With a formidable force he proceeded to the north, and engaged the combined Prussian and Russian army in a general action near Lutzen, the result of which was, that the allies kept the field, and the French retreated. Bonaparte afterwards advanced to the Elbe, and his troops occupied Dresden, Leipsic, and Breslau. The accession of Sweden to the league against the French emperor, by which he engaged, in consequence of a subsidy from Britain, to furnish 30,000 men on the continent, threw something in the balance in favour of the allies. Napoleon, foreseeing the difficulties which were rising around him, proposed an armistice, which was agreed to; but was at length broken up by the Austrian minister delivering to the French minister a declaration of war on the part of his court against France, when hostilities were resumed. The allies attacked Dresden, which was strongly fortified, and defended by Bonaparte with a force estimated at 130,000 men. A severe action took place, at the conclusion of which the allies retired. After various movements and successes on the part of the allies, the French retreated towards the Elbe, and the city of Leipsic became the great scene of contest between the contending armies. At this time the accession of 55,000 Bavarian troops strengthened the allies. The engagement commenced on the 16th October; on the 17th preparations were made for greater efforts; and after a dreadful conflict on the 18th, in which the French had lost 40,000 men, in killed, wounded, and prisoners, the town was carried on the succeeding day, after a short resistance, and the allied sovereigns entered it two hours after Bonaparte had made his escape. The French army retreated in great disorder; the allies continued the pursuit, and, excepting those of the French who were left in the garrisons, liberated the whole of Germany from the troops of the invader.

Holland also shared the benefits of this revolution. The approach of the allied troops to Amsterdam encouraged the people of that city to throw off the yoke of France, and to proclaim the sovereignty of the house of Orange. A deputation was sent to London to invite the prince to resume his authority; and, with the aid of England, he made his entry into Amsterdam on the 1st of December. The allies continued to advance on various points of the French frontier; and Bonaparte, seeing the country in a state of invasion, had recourse to extraordinary measures to secure the means of its defence.

America.—The Americans still directed their enterprises to Canada, and various actions took place in the course of the summer, between the naval armaments on the lakes, or the land forces on their shores. Offensive warfare was also carried on against other parts of the American territory, and particularly on the rivers at the head of Chesapeake bay, at Hampton in Virginia, and on the coast of North Carolina.

1814.—The peculiar situation of France, at the commencement of this year, arrested the attention of all Europe. The allied armies had crossed the Rhine, and were advancing to the interior; and, after various actions, some of which were strongly contested, continued their progress. Negociations for peace were entered into at Chatillon, where the plenipotentiaries of the different powers met; but they terminated unsuccessfully, and the allies proceeded to the vicinity of Paris, which was defended by the French army under Joseph Bonaparte. Their position on the heights near Paris was carried, after an obstinate resistance. A cessation of hostilities took place, and Paris being evacuated, the allied sovereigns entered it on the seventh day. A provisional government was established; Bonaparte was deposed, and had the isle of Elba, in the Mediterranean, in full sovereignty, assigned to him for life. In the meantime Lord Wellington was advancing into France; a part of his army had entered Bourdeaux in March; and that city declared for the Bourbons. The British general proceeded to Toulouse, in pursuit of marshal Soult, and a smart action took place on the 10th of April, after which the town was evacuated by the French army. The intelligence of the transactions of Paris also produced a suspension of hostilities in this quarter.

While Bonaparte was proceeding to take possession of his small territory, the head of the Bourbon family emerged from his retirement in England, was hailed as a sovereign, and made a public entry into London. On 24th April he embarked at Dover, was welcomed at Calais with every mark of loyalty and affection, and on the 3d May made a solemn entrance into Paris. The treaty of peace between the allies was signed at Paris on the 30th of May. By this treaty the boundaries of France were to be such as they were in 1792, and all the colonies, factories, and settlements which she possessed at that period to be restored, with the exception of Tobago, St Lucia, and the isle of France. Malta and its dependencies are to belong to Great Britain, and the latter power resigned all conquests from the Dutch, exclusive of the Cape of Good Hope, Demerara, Essequibo, and Berbice. The electorate of Hanover, with certain annexations, acquired the title of a kingdom, under his Britannic majesty.

The subject of the corn laws was discussed in parliament towards the close of the session; the budget of the year was laid before the house in June, and the amount of supplies exceeded L.75,600,000; and among the ways and means were two loans of forty millions and a half, and a vote of credit for three millions; and a bill was passed for suppressing outrages in Ireland.

America.—The warlike operations on the frontiers of Canada were conducted with great vigour, and with various success. Many smart actions took place between the naval forces of the different powers on the lakes, as well as some severe contests with the troops on shore. An attempt was made with a strong force to penetrate into the state of New York, but it failed. The attack on the city of Washington, the new capital of the United States, was more successful. The arsenal, dock-yard, treasury, senate-house, and other public buildings were committed to the flames. Private property was respected, and strict discipline was kept up among the troops; but still the destruction effected in this expedition was much regretted by many. The town of Baltimore was the next object of attack by the same force; but the number and strong posi-

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tion of the Americans who defended it, rendered the attempt impracticable. It was, therefore, abandoned, with the loss of general Ross, the commander of the troops, who fell in the advance. Negociations for peace with America, which had for some time been going on between the commissioners of the two powers, who met first at Gottenburgh and then at Ghent, were finally concluded on the 24th December, when a treaty of peace was signed between Great Britain and the United States.

1815.—The consideration of the corn laws was resumed in parliament this year, and, after long discussions, the price of wheat, which regulated other kinds of grain, at which free importation was permitted, and below which it was prohibited, was fixed at 80s. per quarter. A bill for the introduction of trial by jury in civil causes in Scotland passed into a law, but it was left optional with the judges of the court of Session in what cases such trials should be granted. In consequence of the great events which were then in agitation, the supplies required from Great Britain amounted nearly to the enormous sum of 80 millions, exclusive of nine millions and three quarters for Ireland, and a vote of credit of six millions.

America.—At the very time that the preliminaries of peace were agreed to and signed between Great Britain and the United States, some active military operations were going forward in a distant quarter of the American territory. In the last week of the preceding year and the commencement of the present, a meditated attack on New Orleans was put in execution. In the advance to a strong position occupied by the Americans, general Pakenham, the commander, was killed; the two generals next in command were wounded, and one of them mortally; the troops were disheartened and fell back in disorder, and the enterprise, which now seemed hopeless, was abandoned with great loss to the assailants. But the army afterwards re-embarked with all their stores. Fort Mobille capitulated to a British force in the beginning of February; and this was the concluding action of the war.

East Indies.—In the close of last year, disputes between the British government and Bengal and the Nepaulese at last broke out into open hostilities; and after some active warfare, which was followed with various success, the whole tract of border-land, which was the subject of difference, was annexed to the territory of the East India company. The whole of the island of Ceylon fell under British authority this year. The conduct of the king of Candy had become extremely oppressive to his own subjects, and with the assistance of the British troops, who advanced into the interior, they threw off his yoke, seized his person, declared his right violated, and placed themselves under the protection of the government of Great Britain. This revolution, it can scarcely be doubted, will prove favourable to the liberties of the natives.

Affairs of France.—The scenes of deepest interest which occupied the attention of Europe, were exhibited in France in the course of this year. After some previous preparations, which passed without suspicion, the ex-emperor of France departed from Elba, on the evening of the 26th February, with about 1000 troops, embarked in five vessels. He landed in France on the 1st March, and having proceeded to Lyons without opposition, he entered that city, and was hailed as emperor by the soldiers and the populace. Marshal Ney, who had made a voluntary offer of his services to the king to oppose the invader, joined him with his whole division; and the king despairing of support from the army, left Paris on the 19th. It was entered by Bonaparte on the next day, without the slightest opposition in his progress. The commissioners of the allied powers, then at Vienna, issued a declaration, in which they bound themselves to maintain the conditions of the treaty of Paris, and not to relax their exertions, till the usurper should be deprived of the means of renewing his attempt on France. In the end of last year, the whole fortified frontiers of the Belgic provinces, on the side of France, was occupied by strong garrisons, either of British troops or of those in the interest of Britain; and from the commencement of the alarm of the invasion, reinforcements had been dispatched from this country, and the chief command was committed to the duke of Wellington. The Prussian army, commanded by prince Blucher, arrived in the end of May, and the plan of co-operation was arranged between the two generals.

Bonaparte left Paris on the 12th June, and having placed himself at the head of a numerous and well appointed army, animated with enthusiasm, and full of confidence in their leader, he assailed the Prussian posts on the 15th; the Prussians were again attacked next day, and, after a severe conflict, were forced to retire before such superior numbers. Lord Wellington, in the mean time, advanced with his whole army upon Quatre Bras, with the intention of supporting the Prussian general; but he was himself attacked by a large body of cavalry and infantry, with a powerful artillery; and although the repeated charges of the French were steadily repulsed, a considerable loss was sustained on the part of the allies. The combined armies retired in the night, and on the morning of the 17th, retired to Waterloo. On the morning of the 18th, Bonaparte collected his whole force on the heights opposite to the British army; and, at 10 o'clock, the action commenced. A heavy cannonade was kept up against the whole British line, and repeated charges of infantry and cavalry were made in the course of the day, all of which, excepting in one case, were uniformly repulsed. Late in the evening, a desperate onset against the left of the British centre took place, and a severe contest followed. But the Prussians who had been attacked by another division of the French army, fell on the flank of the enemy, who began to retreat, and the duke of Wellington seizing this opportunity, advanced with his whole line of infantry, supported by the cavalry and artillery. The French, unable to withstand this vigorous movement, fled with the utmost precipitation, and left on the field about 150 pieces of cannon, with their ammunition. On no former occasion were the valour of British troops, and the talents of their noble commander, more conspicuous. The loss sustained on the part of the British, in so sanguinary a conflict, was unusually severe. Of killed, wounded, and missing, of the British and Hanoverians, the number exceeded 12,000; two generals, and four colonels fell on the field; and nine generals and five colonels were among the wounded.

Bonaparte seeing his fate decided, hastened back to Paris; and after some ineffectual measures to recover his power, was forced to declare that his political life was terminated. On the 3d July he arrived at Rochefort, and seeing no prospect of escape, went on board a British ship of war, and was in a short time, by the determination of the confederate sovereigns, conveyed to St Helena, which was destined to be the place of his future residence. The allied armies pushed forward to Paris, and, after some resistance, took possession of the city, in terms of a convention with the chambers, in whom the temporary authority was placed. But in a short time Louis XVIII. returned to the capital, and was restored to the throne; and to preserve the tranquillity of France, and it may be added, of Europe, a considerable body of troops, in the pay of France, belonging to the allied powers, was to retain the occupation of strong holds on its frontiers for a limited period.

BRITAIN, NEW, an extensive district of North America, having Hudson's bay and strait on the north and west, Canada and the river St Laurence on the south, and the Atlantic ocean on the east. It is also called Labrador.—See LABRADOR.

BRITAIN, NEW, a large island at the eastern extremity of Papua, or New Guinea, in the Southern Pacific ocean. This island presents a mountainous appearance, and is well wooded; the vallies are fertile, producing cocoa-nuts, yams, and ginger; it is well watered with numerous streams, and very populous. The inhabitants appeared to be hardy, well made, and of a dark copper colour.

BRITANY, a province of France before the revolution.—See BRETAGNE.

BRIXEN, the capital of a district of the same name in the Tyrol, stands on the banks of the river Eisach, and is surrounded with mountains, which are clothed with vineyards. The houses are well built; some of the public buildings are respectable structures, and several squares are spacious and commodious. The mineral waters in the vicinity attract a good deal of company; and a red wine, which is produced in the surrounding territory, furnishes the chief commodity for the trade of the place.

BRIZA, QUAKING-GRASS, a genus of plants belonging to the class Triandria, and of which several species are natives of Britain.

BROACH, or BROTCHE, from a French word, which signifies an awl, or bodkin, is employed in Scotland to denote an instrument corresponding with the *fibula*, or clasp of the Romans, for the purpose of fastening the vest, or upper-garment. The broach is usually made of silver, sometimes of a roundish form, and sometimes heart-shaped; and it is furnished with a tongue, crossing its diameter, or with two tongues, one on each side of a cross-bar in the middle, to fasten the folds of the garment. Some broaches are of elegant workmanship, and richly ornamented, are carefully preserved in families, and in former times particular virtues were ascribed to them, so that they seem to have been employed as amulets.

BROACH, a district of the province of Guzerat, lying on the west coast of India, between the 21° and 23° of N. latitude, and having the gulf of Cambay for its western boundary. This territory, which is one of the most populous and best cultivated on that coast, was acquired by the British in 1803. In many places the soil is extremely fertile, and produces abundance of rice and cotton. Numerous villages are scattered over the province, and, before it came under the dominion of the British, robberies and murder, from being passed over with impunity, or visited only by slight fines, were very frequent. But it is gratifying to find that the security of life and property is now greatly improved, by the more rigorous and equal administration of the laws. Superstitious devotion is a striking feature in the character of the Hindoos of this province. When far advanced in years, or absorbed in spiritual contemplation, those who have acquired the reputation of great sanctity not unfrequently submit to be smothered alive, in a pit dug by themselves or their disciples. This was the fate of Kubeer, a famous saint, from whose toothpick, according to the tradition of the country, sprung the celebrated banyan tree, which grows in an island in the Nerbudda, and is justly reckoned the most extraordinary vegetable production in existence.—For an account of this tree see *Ficus*, under BOTANY.

BROACH, the capital of the district of the same name, in the province of Guzerat, in the East Indies; stands on the north bank of the Nerbudda, about 25 miles from its junction with the sea. The manufacture of cotton stuffs is extensive, and the waters of the Nerbudda have been long celebrated for their peculiar property of communicating a pure white to the cloth. The price of labour is extremely low; the wages of a man is about 4d. a day, of a woman about 3d. and of boys and girls from one halfpenny to 2d. and even these rates are nearly double those of the manufacturing districts in Bengal. The population of the town and of the district immediately attached to it, exceeded 80,000 before 1791, when a great famine carried off more than 25,000.

An hospital for animals is supported at this place by the donations of the Hindoo inhabitants, and every marriage and mercantile transaction is taxed for the expence of the establishment, and in this way an annual revenue of L.1000 Sterling is acquired, the greater part of which goes to enrich the managers. No other animals beside milk cows are admitted of late years to this asylum, and the profit which they yield is equal to the expence of their support. Broach is 221 miles from Bombay, and 287 miles from Poonah.

BROCADE, or BROCADO, in its more limited meaning, was employed to signify a stuff or cloth composed entirely of gold or of silver, or of a mixture of both; but in a more enlarged sense, it is applied to a stuff of gold, silver, or silk, raised and enriched with flowers, foliage, and other ornaments, according to the fancy of the manufacturer. See Cloth Manufacture.

BROEK, a large village of North Holland, which is remarkable for the cleanness and neatness of the houses and streets. The houses are built of wood, and roofed with tiles, and the streets, into which neither carriages nor cattle are admitted, are paved with bricks well polished, and strewed with sand. The outside of the houses is painted with brilliant colours, and the gardens, in which no weed is ever allowed to appear, are furnished with the choicest flowers, and adorned with beautiful shell-work. The commercial intercourse of Broek with the Baltic and some of the mercantile cities in the north of Europe was formerly considerable; but the trade now is chiefly confined to corn and cattle. Merchants who have retired from business, or who are connected with mercantile concerns in Amsterdam, are the principal inhabitants.

BROKER, a person who is employed to manage affairs, or to conclude bargains relative to money and mercantile transactions. Brokers have been distinguished by different denominations, according to the nature of the business which they manage, as Exchange-brokers, Insurance-brokers, Stock-brokers, and Pawn-brokers.

Exchange-brokers are agents who transact the business of exchange between the merchants of different countries. Those who exercise this business in London are required by law to have a licence from the lord mayor and aldermen, and to give bond for the faithful performance of their office; and if any person act as a broker without being thus licensed and admitted, he is subject to a penalty of L.500, and those who employ any such persons forfeit L.50.

Insurance-brokers are employed in transacting the business of insurance between the merchant or party insured, and the insurers or underwriters. The nature of the transactions in which agents of this kind are engaged, requires that they should be persons of honour and respectability, in whom great confidence may be placed. By the ordinary practice of trade in London, the underwriters give credit only to the broker for their premiums, and can have recourse on him only for payment, while he alone, and not the underwriters, can recover the premiums from the insured. But the duties and obligations of Insurance-brokers may be seen at large in Marshall's *Treatise on Insurance*.

Stock-brokers are agents employed to buy and sell shares in the joint stock of a company or corporation, and also in the public funds. The transactions relative to the purchase and sale of stock in the public funds, usually come under the denomination of *stock-jobbing*. As the practice of stock-jobbing has been often carried to such an excess as to become not only highly injurious to private individuals, but even in some degree to affect public credit, it has been placed under strict regulations by legislative enactments. Among other things, it is enacted, that contracts in the nature of wagers incur a penalty of L.500; and by the sale of stock of which the agent is not possessed, a forfeit of L.100; and that brokers keep a book, in which all contracts, with their dates, and the names of the parties concerned, shall be recorded, under a penalty of L.50.

Pawn-brokers, or *pawn-takers*, are persons who lend money upon pledges, and usually at a high rate of interest. As the embarrassed affairs of persons who pledge goods are apt to expose them to imposition and fraud, the business of pawn-broking is strictly regulated by the legislature. Pawn-brokers are required to take out an annual licence, on a L.10 stamp, within the bills of mortality of London, and on a L.5 stamp in any other part of the kingdom, for each shop kept, under a penalty of L.50 Sterling.

According to various enactments, the following are the rates of profit allowed to brokers for interest and ware-house room. For every pledge, on which there has not been lent above 2s. 6d. one halfpenny per month; for 5s. one penny; for 7s. 6d. one penny halfpenny; for 10s. twopence, and so on progressively in the same proportion for any sum not exceeding 40s.; and for any sum exceeding 40s. and not exceeding L.10, at the rate of threepence for every 20s. Pawned goods may be redeemed within seven days after the expiration of any month without paying interest for the seven days; but after seven, and within sixteen days, interest for one month and a half is due. After the first fourteen days, the pawn-broker is entitled to interest for the whole month.

By other regulations, the pawn-broker is required to make entries and to give duplicates. If he refuse to deliver up goods pledged within one year, on tender of the money with the interest due, a justice of peace is authorised to commit him till satisfaction be obtained. After the expiration of a year, pawned goods may be sold by public auction; but they must be exposed to public view, catalogues must be published, and two advertisements of sale must be inserted in some newspaper, at least two days before the first day's sale; and in case of failure, the pawn-broker subjects himself to a forfeit of L.5 to the owner. Pawn-brokers receiving notice from the owners of goods before the expiration of a year, are not allowed to dispose of the goods until three months from the termination of that year. They are required to enter in their books an account of sales of all goods pawned for more than ten shillings; and in case of sale, the overplus must be paid to the owner, if demanded, within three years, interest and costs being deducted, under a penalty of three times the amount of the sum lent. Pawn-brokers are prohibited from purchasing goods in their custody, or suffering them to be redeemed with that view; from lending money to persons appearing to be intoxicated, or under 12 years of age; from purchasing duplicates of other pawn-brokers, and from buying goods before eight in the morning and after seven in the afternoon. Besides various other regulations specified in the enactments on the subject, and in those cases where no penalty is provided, pawn-brokers shall forfeit L.5 for every transgression of the law.

BROMELIA, the Pine-apple, a genus of plants belonging to the class Hexandria. See Botany; and for the mode of cultivating this delicious fruit, see Gardening.

BROMLEY, a market-town of Kent, in England, situated on the banks of the river Revensbourne, contains about 3000 inhabitants, and is chiefly remarkable for a charitable establishment founded by Dr Warner, bishop of Rochester, in the time of Charles II. and destined for the support of twenty females, the widows of poor clergymen. A bequest of L.10,000, by Mrs Betenson of Bradbourne, and another, still more liberal, of L.12,000 by Mr Pearce, names which are well entitled to be transmitted to posterity, have greatly enriched this excellent institution. A spring in the vicinity of Bromley, affords a mineral water, whose properties are similar to that of the celebrated Tunbridge-wells.

BROMSGROVE, a market-town of Worcestershire in England, stands on the river Salwarp, and is 12 miles distant from Worcester, and 116 miles from London. An elegant church, on an elevated spot, with an approach by a flight of fifty steps, furnished with windows of painted glass, and containing some fine monuments of eminent characters, is the chief ornament of the place. The number of inhabitants is about 6000, and they are chiefly employed in the manufacture of woollen and linen cloth, and various kinds of hardware.

BROMUS, Brome-grass, a genus of plants belonging to the Triandria class, and including twelve species, which are natives of Britain, one of which, *Bromus Sterilis*, or Barren Bromegrass, is very common in fields, hedges, and waste places.

BRONCHOCELE, a peculiar tumour which is produced on the anterior part of the neck, and to which some of the inhabitants of the districts round the foot of the Alps of Switzerland, and some other countries, are much subject.

BRONZE, a metallic alloy, composed generally of copper and tin, but sometimes zinc, lead, or silver is added to communicate the sonorous property required for some of the uses to which this compound metal is applied. Bronze has been much employed for casting statues, both in ancient and modern times; and for this purpose it is peculiarly proper from its durable quality.

BRONZING, is the art of communicating to figures of plaster, wood, or ivory, the appearance of real bronze figures. Two kinds of bronze, the yellow or golden, and the red, are employed for this purpose. The golden bronze is prepared of the finest and brightest copper dust; and when a red bronze is required, a small portion of red ochre, reduced to a fine powder, is added. Both kinds of bronze are applied with varnish, and to prevent the surface of the work from assuming a greenish colour, it is dried over a chafing-dish as soon as the process is finished.

The following process of bronzing is easily practised: The figure is first covered with a coat of gum-water, to which a little minium has been added; a small portion of fish glue is then dissolved in spirits of wine, by digesting them in a warm place, and the mixture is coloured with a little saffron; the filings or dust of the metal which is desired to be imitated, is mixed with the glue and applied to the figure, by means of a hair pencil.

The following method of bronzing copper is practised by the Chinese. To clean and polish the surface, it is well rubbed with vinegar and ashes, and it is afterwards well dried in the sun. Two parts of verdigris, two parts of cinnabar, five parts of sal ammoniac, two parts of the bile and liver of ducks, and five parts of alum are pounded, well mixed, and formed into a paste. The copper being heated, is covered with a coating of this paste; and after being dried, cooled, and washed, the same operation is repeated, till a covering of sufficient thickness is obtained.

BROOKE, Henry, a dramatic poet and novel writer of considerable reputation, was a native of Ireland, and was born about the year 1706. Having completed the earlier part of his education under the tuition of the celebrated Dr Sheridan, he became student of Trinity college, Dublin; and with the view of qualifying himself for the profession of the law, he resided sometime in the Temple. He married his cousin on his return to Ireland, and lived for some time in retirement; but the increase of his family, and of his expenditure, required an addition to his income; and for this purpose he had recourse to the exertion of his literary talents. About the year 1735, he visited London, and published his *Universal Beauty*, a philosophical poem; and having failed, from want of industry or inclination, in an attempt to establish himself in the practice of the law in his native country, he returned to the same metropolis, and produced the tragedy of *Gustavus Vasa*, which, from the peculiarity of its sentiments, excited great attention among the different political antagonists of the day, was applauded by one party and condemned by another, and its public representation at the theatres was prohibited by government. But the author was fully compensated by publishing the play by subscription, which was encouraged and promoted by the friends and adherents of the prince of Wales. He produced, in 1745, another tragedy, the *Earl of Westmoreland*, which was acted at the Dublin theatre; and four years afterwards, the *Earl of Essex*, which was represented at the same theatre, and at Drury-lane in 1760. In 1762, he published the *Trial of the Roman Catholics*; in 1766, the *Fool of Quality*, a novel, which attracted much notice, and continued long a favourite with the public; and, in 1774, *Juliet Granville*, a work of the same description. Mr Brooke also contributed three pieces to "Moore's Fables for the Female Sex," of which the *Female Seducers* has been much admired.

The pecuniary affairs of Mr Brooke, which seem to have been always embarrassed, obliged him, during the latter period of his life, to unite his family with that of his brother, but they lived together in great harmony. His mind had been long tinctured with religious melancholy, and this depression of spirits, with the loss of his wife after a union of nearly fifty years, and the death of a favourite child, actually induced mental derangement. Having reached the venerable age of 77, he was relieved by death from all his worldly cares in October 1783.

BROOME, William, an English poet, was a native of Cheshire, and descended of parents in a humble rank of life. He was educated on the foundation at Eton; and, by the contribution of his friends, was sent to St John's college, Cambridge, where he obtained a small exhibition; and he resided for some time in the same chamber with Mr Ford, who described him to Dr Johnson as a contracted scholar, and a mere versifier, unacquainted with life, and unskilful in conversation; and hence he was familiarly called by his companions, *the poet*. Mr Broome was early known as a translator of Homer into prose, in conjunction with Ozell and Oldisworth. A visit of Pope to a friend in the vicinity of Cambridge, afforded him an opportunity of being introduced to that poet, who employed him in making extracts from Eustathius, for the notes to the translation of the Iliad; and in the volumes of poetry called "Pope's Miscellanies," many of Broome's early productions are inserted.

When Pope was engaged to undertake a version of the Odyssey, he assigned part of the labour to Fenton and Broome; and the translation of the second, sixth, eighth, eleventh, twelfth, sixteenth, eighteenth, and twenty-third books, with notes to the whole poem, was contributed by the latter. The scanty remuneration which Broome received, amounting only to L.600, while half the sum was paid to his coadjutor, Fenton, for four books, produced a coldness and open hostility with Pope. Broome charged Pope with his avarice; and Pope, in revenge, introduced Broome into the Dunciad. Broome afterwards published a Miscellany of Poems; and, towards the close of life, he amused himself with translating the odes of Anacreon, which appeared in the Gentleman's Magazine under the name of *Chester*. He obtained several livings in the church, but never rose to a higher dignity than that of rector. He died at Bath in 1745. "Though it cannot be said of him," Dr Johnson remarks, "that he was a great poet, it would be unjust to deny that he was an excellent versifier: his lines are smooth and sonorous, and his diction is select and elegant."

BROSELEY, a market town of Shropshire in England, situated on the river Severn, and 146 miles from London. The population is about 5000; and the inhabitants are occupied in extensive iron-works in that neighbourhood, in the manufacture of glazed tobacco-pipes, and in mining, and the coal-trade. Broseley is remarkable for a burning spring in the vicinity, discovered in June 1711 by a singular noise in the night, which awoke and drew a number of people to the spot, who observed a shaking of the earth, and the water boiling up through the grass. The spring being dug round, the water sprung to a great height, and taking fire from a candle which a person held in his hand, great curiosity was excited. To secure the spring, an iron cistern was placed upon it, having a small hole in the centre. A candle being put to the hole, the water took fire, and was most violently agitated. It would sometimes burn for forty-eight hours without intermission; and so great was the heat, that a tea-kettle full of water being placed on the hole, would boil in nine minutes. It entirely disappeared in 1755, by the sinking of a coal-pit. It seems probable that the inflammable air, rising through the water, and taking fire when a burning body was brought in contact, was the cause of the remarkable effects of this spring.

BROSSES, Charles, De, a learned French author, best known by the appellation of President de Brosses, from his official situation in the parliament of Burgundy, was born at Dijon in 1709, and was early distinguished by his literary and scientific pursuits, to which, in the midst of professional avocations, his attachment continued through life. A visit to Italy, in 1739, afforded him an opportunity of examining the subterraneous city of Herculaneum, the first account of which he published on his return to France in 1750. His most celebrated work, *The History of Voyages to the South Seas*, which was undertaken, it is said, at the suggestion of Buffon, appeared in 1756, in two volumes 4to. In this work, the southern portion of the globe is distributed under two great divisions, Australasia and Polynesia, an arrangement which some succeding geographers have adopted. He was the author of a treatise on the mechanical formation of languages; and he devoted a great part of his life to a translation of Sallust, in which he endeavours to supply the chasms in the work of the Roman historian. This elaborate work was published in 1777, in eight volumes 4to. On the subjects of Grammar and Music, de Brosses was a contributor to the French *Encyclopedié*, and he furnished various memoirs to the transactions of learned academies of which he was a member. He died in 1777.

BROUSSONET, P. M. Auguste, an eminent French naturalist, was born at Montpellier in 1761, and was originally destined for the medical profession, to which the course of his studies was directed. He had the good fortune to be nominated to the chair of botany in the university, at the early age of 18, and to that branch of natural history he assiduously devoted himself. Strongly impressed with the advantages of the Linnæan classification, he employed his most zealous exertions in subduing the opposition which it experienced, and in attempting to establish it in France. In the prosecution of his favourite study, and to extend his knowledge of other departments of natural history, he visited Paris and London, and spent much of his time in examining the splendid collections which have been made for its elucidation. During his visit to the latter capital in 1782, he published his celebrated work on fishes, in which most of the rare species are described and figured.

Broussonet was early involved in the troubles of the French revolution. He became a member of the electoral college of Paris in 1789, an official situation, which required him to perform the duty of a public magistrate, in the exercise of which he was obliged to witness the most horrible outrages, to see his friends murdered, and his own life exposed to the most imminent danger; he was appointed, in 1791, a member of the legislative assembly; but, wearied with the tumults and barbarities of the times, he retired to his native city; fled from the danger which still pursued him to Madrid and Lisbon, and was at last compelled to accept of the office of physician to an embassy from the United States of America to the emperor of Morocco. Having obtained permission from the French directory to revisit France, he repaired to Teneriffe, where he spent two years in the rank of consul; and, when he returned to his native country

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in 1796, he was recalled to his professorship at Montpellier. He died in 1807. Beside the work on Fishes, he wrote a treatise on Respiration, and some others on subjects of rural affairs.

BROWN, Dr John, a clergyman of the church of England, and a multifarious writer, was born at Rothbury in Northumberland in 1715. His father, a native of Scotland, was the curate of the place, and was afterwards removed to Wigton in Cumberland, where the son received the early part of his education. He entered as a student in St John's college, Cambridge, took the degree of bachelor of arts, and returning to his native county was admitted to the clerical profession, and appointed canon and lecturer in the cathedral church of Carlisle. During the rebellion in 1745, he distinguished himself by his intrepidity in the defence of Carlisle. Excepting as a preacher, Dr Brown first appeared before the public as a poet, in two productions, the one entitled *Honour*, and the other *An Essay on Satire*, neither of which is now much known or read; but his Essays on the Characteristics of Shaftsbury, seem to have brought him greater reputation. In 1755 he became known as a dramatic writer in the tragedies of *Barbarossa* and *Athelstan*, the first of which obtained a large share of popularity; and in 1757 he published his *Estimate of the Manners and Principles of the Times*, a political work, to which Voltaire ascribes great influence in rousing the languid exertions of the nation. Dr Brown wrote also on other political subjects, on Poetry and Music, on Female Education in a sermon, a Letter to the Author of the Divine Legation of Moses, and Dialogues of the Dead.

The closing scene of Brown's life presents a melancholy picture of the connexion which too often exists between powerful genius and an ill regulated mind. In 1765 he had corresponded with a friend in Russia on the subject of establishing schools in that country, and had accepted an invitation from the empress to take an active share in conducting them. Preparations were made for his journey, and money was transmitted to defray the expences; but a severe indisposition intervened, and at last, through the advice of his friends, he relinquished the undertaking. The failure made a deep impression on a sanguine mind, and led at last to the commission of suicide; a horrid purpose, which, it is said, he had often meditated, and had even warned his friends of the dreadful apprehensions which haunted his soul. The fatal deed was executed in 1766, when he had reached the 51st year of his age.

BROWN, John, a physician, and founder of a theory of medicine which bears his name, was a native of Berwickshire in Scotland, and was born about the year 1736. Descended of parents in a humble rank of life, he was destined, when very young, to a mechanical profession, the drudgery of which he either disliked, or the talents which he discovered shewed that he was capable of rising to a more conspicuous rank; and in the grammar-school of Dunse, where he was placed, he soon gave the most satisfactory proofs, by his ardour and success in study, of his capacity for literary pursuits. His parents, who were of that class of dissenters called seceders in Scotland, encouraged by his rapid progress in the Latin language, proposed that he should be educated for the clerical profession among their own sect. But as young Brown was little disposed to adhere rigidly to their peculiar tenets and practices, he seems to have disavowed his connection with that sect as early as his 13th year, and to have become a member of the established church. Having been employed for some time, either as a private tutor in a gentleman's family in the country, or as an assistant in the grammar-school of Dunse, he went to Edinburgh in his 20th year, and having completed the requisite course of study in the classes of philosophy in the university, he entered himself as a student of divinity; and it is highly creditable to young Brown, that during the time of his studies at Edinburgh, his talents and industry enabled him, by private teaching, to support himself. After a short retirement in the country, he returned to Edinburgh in the year 1759, when he commenced the study of physic, and finally renounced that of divinity.

While he prosecuted his medical studies, he was still indebted for support to his literary attainments. He was much employed in giving private instructions to students, in colloquial exercises in the Latin language, which are necessary for those who are examined for medical degrees in the university, and in translating inaugural dissertations into the same language. By these labours he recommended himself to Dr Cullen, who not only warmly patronised, but received him as a private tutor in his own family. The conversation of that eminent man and celebrated professor, and the friendly and familiar terms on which he lived with him, as well as the permission which he obtained of delivering private lectures, or illustrations of the doctor's public lectures, to a number of pupils, could not fail to be highly beneficial to the progress of Mr Brown's medical studies. With these flattering prospects he married the daughter of a respectable tradesman in Edinburgh, and opened a house for receiving students as boarders. Having the hope of deriving great benefit from his instructions and conversation, many pupils in a short time crowded his apartments. But want of economy, or mismanagement, produced a serious embarrassment in his affairs; and the disappointment of obtaining a medical professorship in the university, which he ascribed to the interference of Dr Cullen, soured his mind, and led to an open rupture with his patron and friend.

From this quarrel, in which it has never been stated what share of blame was due to Dr Cullen, the celebrated theory of Brown, it is said, derived its origin; but it is surely little creditable to the reputation of the theorist, that the new doctrines arose from irritated feelings, rather than from a desire to investigate the truth. The opinions of Brown were received and supported with enthusiasm by one party, while they were condemned and rejected by another. In the collision of sentiments and opinions on the disputed subjects, all the rage of religious controversy frequently appeared, and, to complete the resemblance, even some degree of persecution was not wanting. All this tended to unite more closely those who took the same side; and it was peculiarly unfortunate for the author of the new theory, that his convivial habits led him to form clubs and societies, which met in taverns for very different purposes from matters of mere speculation. The institution of a masonic association, in which the conversation was conducted in the Latin language, with the view of gaining proselytes to his doctrines, or of attracting students to his lectures, is probably to be traced to a similar origin.

The *Elements of Medicine*, written in Latin, first appeared in 1780. This work contains a comprehensive view of his opinions, which were more fully illustrated in his public lectures, which he delivered for several years; and, as it was his intention to prosecute the profession of medicine by private practice and public instruction, he obtained a medical degree from the university of St Andrews; the application for which at his own university, in consequence of the irritation which subsisted between him and the professors, it is supposed would have failed. But his labours, owing chiefly to his unfortunate habits, were unsuccessful. He removed to London in 1786, and having delivered a course of lectures before 1788, he was seized with apoplexy in the month of October of that year, on the very day when he had commenced a second course, and when he had reached the 53d year of his age.

A view of Brown's peculiar doctrines, which constituted his once celebrated, but now nearly forgotten system, could scarcely afford any interest to the general reader. The medical student may be referred to the work itself, or to an edition of the *Elements of Medicine*, published by Dr Beddoes, to which is prefixed a life of the author. But it may be observed in general, that the writings of Dr Brown, either from the unsettled nature of his principles, or from the obscurity of his expressions, are often dark and ambiguous, and his style is frequently harsh and unpolished; and it may be added, that the mechanical, or chemical illustration of the theory, which has been attempted by the author, or his followers, contributes little to its perspicuity.

BROWNISTS, a religious sect which appeared in England about the end of the 16th century, and derived its origin from Robert Brown, a native of Rutlandshire, who had been educated at Cambridge, and had been sometime a schoolmaster in the vicinity of London. Being admitted to the clerical profession about the year 1580, he began to inveigh openly against the discipline and ceremonies of the established church; and for this he was frequently prosecuted before the ecclesiastical courts, and subjected to imprisonment. His followers assumed the name of Brownists, and not only separated from the church, but refused to join in the public offices of religion with any other Christian society. The violence of his conduct, or the persecution which he suffered, forced him to leave the kingdom; and, with the permission of the states of Holland, he and his followers settled at Middleburgh in Zealand, and modelled their church according to their own peculiar views. But repose and freedom from restraint, seemed little congenial to the temper of these sectaries; divisions took place among themselves, and Brown, their leader, resigned his office, and returned to England in 1589. For some time his hostility to the church continued; and being again prosecuted, sentence of excommunication was pronounced against him. At last, such was his wavering conduct, he renounced his principles of separation, was restored to the church, and preferred to a rectory in Northamptonshire. But in this situation his life is represented as idle and dissolute; and in consequence of a quarrel with the constable about the payment of parish taxes, he was thrown into prison, where he died in 1630, and in the 81st year of his age.

The peculiar principles of the Brownists refer to the discipline and ordinances, rather than the doctrines of the church of England. Every society enjoyed the full power of choosing its own pastors, of regulating its own concerns, and, altogether unconnected with other congregations, formed within itself a complete church. The pastors and office-bearers of the church were appointed by the congregation, which reserved the power of removing them when the spiritual benefit of the community required it. From the sect of the Brownists, which continued for nearly 100 years, arose the Independents, whose constitution and discipline are nearly the same.

BROWNRIGG, Dr William, a learned English physician, was a native of Cumberland, and was born about the year 1712. Little is known of the early part of his life; but being destined for the medical profession, and having completed the previous requisite studies in his own country, he repaired to Leyden, the celebrity of which, at that period, attracted crowds of students from all quarters; and he had the good fortune to finish his medical education under the eminent professors Albinus and Boerhaave, whose unrivalled reputation then added the highest splendour to that university. Having obtained a degree in medicine in 1737, he returned to England and settled at Whitehaven, where he soon acquired the most extensive and the most respectable practice. Dr Brownrigg seems to have been strongly attached to chemistry, and to have devoted much of his leisure time to enquiries connected with that science. In 1748 he published a treatise *on the Art of Making Common Salt*; sometime afterwards, *an Enquiry concerning the Mineral Elastic Spirit contained in the Water of Spa in Germany*; and in 1771, a work *on the Means of Preventing the Communication of Pestilential Contagion*. In some of these investigations he approached nearly to the curious discoveries of Dr Priestley on the nature and properties of air. For the last twenty years of his life he lived chiefly at his seat near Keswick; and in this retirement he died in 1800, when he had reached the venerable age of 88, lamented by the poor, to whom he was always a beneficent friend, and regretted by all.

BRUCE, Robert, king of Scotland, was the son of Bruce, lord of Annandale, and, the countess of Carrick,—and the grandson of Robert Bruce, the unsuccessful competitor with Baliol for the Scottish throne, and was born in 1274. The father had joined the standard of Edward, and fought in the English army against his native country; but having met with Wallace, in a conference on the banks of the Carron, he was reproached by that patriotic hero for sacrificing the happiness and the independence of Scotland to

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the ambitious views of a foreign prince; and being deeply impressed with his unnatural conduct, he exhorted his son, in his dying moments, to avenge the cause of his country. The injunctions of the father were not lost upon the son. With a bold and enterprising mind, and a vigorous constitution, he had been long inured to the exercise of arms; and the death of Wallace having deprived the Scottish patriots of their dauntless leader, he was chosen his successor. Cuming, lord of Badenoch, being his only rival for the throne, a compromise was entered into with that nobleman; but the treachery of Cuming exposed him to the suspicions of the king of England, and accelerated the execution of his plans for the delivery of the kingdom from foreign oppression. Bruce, aware of the hostile purposes of Edward, found means to escape his vigilance; and having reached Scotland, he assembled his friends, and declared his intention of assuming the crown. He was immediately acknowledged as their sovereign, and measures were adopted for restoring the liberties of their country; but as their safety and success might be endangered by the treachery of Cuming, his death was resolved on; and it is generally admitted that he fell by the hand of Bruce himself.

All reconciliation was now at an end; the vengeance of Edward was urgent, and no alternative remained for Bruce but the most abject submission, and perhaps death itself, or the vigorous prosecution of his bold design. He was crowned at Scone in 1306; but all his exertions were for a time unfortunate; his wife and daughter were made prisoners by the English; and he himself, with a few followers, was compelled to seek an asylum in Rathlin, a small island near the north coast of Ireland. Fearing that a report of his death, which was generally spread, might discourage his adherents and prove injurious to his cause, he landed secretly in Arran, and dispatched a trusty attendant to the opposite district of Carrick, his patrimonial domain, for the purpose of discovering the sentiments of his ancient vassals. He soon after followed, and when he landed with his few friends, he learned that the whole country was in possession of the English. With 300 followers he attacked the English, took the castle of Turnberry, and put the garrison to the sword; and after a severe struggle of eight years, which terminated in the splendid victory of Bannockburn, Bruce saw himself firmly seated on the throne, and the independence of his country secured. Much of the remaining part of his life was occupied in active warfare; many salutary regulations were introduced during his government; and the irregularities of a people who had been long accustomed to plunder and bloodshed were greatly checked by the wisdom and vigour of his administration. He died at Cardross in 1329, in the 55th year of his age, and the 24th of his reign. As he had often intended to visit the Holy Land, he expressed a dying request that his heart should be deposited at the sepulchre of his Saviour; and his tried adherent and faithful companion in arms, Sir James Douglas, was appointed to fulfil the pious wish of his royal master. But Douglas passing through Spain, fell in a battle against the Moors, and the heart of the king was returned to Scotland and buried in the church of Melrose.

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BRUCE, James, the celebrated traveller into Abyssinia, was descended from an ancient family in Stirlingshire in Scotland, and was born at Kinnaird, the family seat in that county, in December 1730. He was instructed in classical learning at Harrow on the Hill, near London, where he was placed in his twelfth year; and he devoted a considerable portion of his leisure hours in acquiring the accomplishments of fashionable life, and in the sports of the field, and other manly exercises. Being originally destined for the profession of the law, he commenced the requisite studies on his return to Scotland, but soon relinquished them, and turned his views to a settlement in the East Indies for the improvement of his fortune. This scheme was frustrated by his marriage, and his subsequent engagement, as a partner in the wine-trade, with the brother of his wife. The mild climate of the south of France was recommended for the declining health of Mrs Bruce, with whom he repaired to that country; but she sunk under a consumption, and died at Paris before a year had elapsed from the time of their marriage.

Partly on account of grief for the severe loss which he had sustained, and the depression of spirits which succeeded, and partly on account of commercial affairs, he travelled in Spain, Portugal, and the Netherlands. Involved in a quarrel at Brussels, and having wounded his antagonist, as it was supposed mortally, he was obliged to make a precipitate retreat from that country; and, in consequence of his father's death in 1758, he returned to England. The fortune to which he succeeded was respectable, but not equal to his ambitious views; and being at first disappointed in some political schemes which he suggested to government, he was appointed consul at Algiers, that he might have an opportunity of prosecuting those plans of enterprize and discovery which he had long contemplated, and for which he had qualified himself by studying the oriental languages. He left Britain in 1762, travelled through France and Italy, and having reached Algiers, he found his residence there greatly harassed by party influence; and being removed from his official situation, he obtained the Dey's permission to examine some of the interior provinces, from which he passed over into Syria and visited the famous ruins of Balbeck and Palmyra.

Mr Bruce had now determined to undertake the arduous journey into Abyssinia, for the purpose of exploring the sources of the Nile; and as he thought it might facilitate his progress to travel in the character of a physician, he received some instructions concerning the prevalent diseases of eastern countries, as well as some books on the same subject from Dr Russel, who was then resident at Aleppo. Thus prepared, he embarked on the Nile, and sailed up that river; and in February 1769, having joined a caravan, he reached Cosseir on the Red sea, passed over to Jidda, and examined a considerable tract of the Arabian coast. He then sailed for Masuah, which is deemed the most convenient place for entering Abyssinia; and here he was detained nearly two months by the treachery and avarice of the governor. On the 15th of November he was permitted to depart from Arkeeko, and in February 1770 he reached

Gondar the capital of Abyssinia, and was fortunate in meeting with a favourable reception from the chief persons belonging to the court. He spent several months in attendance on the king; and it was not till the end of October that he set out for the sources of the Nile, the great object of his perilous enterprise. He reached this long desired spot on the 14th of November; and he describes, with peculiar warmth, the crowd of inward emotions which suddenly rushed upon his mind when he contemplated the accomplishment of his wishes. He returned to Gondar on the 19th of November; and it was not till after nearly two years' residence, and repeated solicitations, that he was permitted to leave Abyssinia. His course homewards was directed through the desert of Nubia, and he arrived at Senaar in the end of April 1772; and after being detained more than four months in a miserable and inhospitable place, in which he says war and treason seem to be the only employment of the horrid people, on the 9th of November having left Gooz, he entered upon the most dangerous part of his journey; all his camels perished, he was forced to abandon his baggage in the desert, and with the utmost difficulty he reached Assuan, upon the Nile, on the 29th of the same month. Having recovered from his fatigues, and procured fresh camels, he returned to the desert and recovered his baggage. On the 10th of January 1773, after more than four years absence, he arrived at Cairo. Ill health detained him for some time at that place; and on his return to Europe he spent sometime in France, where he enjoyed the friendship and hospitality of the celebrated Buffon; and at last he revisited his native country, after a long absence of 12 years. He employed several years in preparing the account of his travels for publication, which at last appeared in 1790, in five 4to volumes, embellished with charts and plates. He entered into a second marriage in 1776, and after a lingering illness, his wife was removed from him by death, in 1784, leaving two sons and one daughter, of which the latter only survives. When he was preparing a second edition of his travels, his labours were interrupted by a fall, in consequence of his foot slipping on the steps in front of his own house, as he attended the departure of some friends. After remaining insensible for some hours, he died on the 27th of April 1794, and in the 65th year of his age.

Mr Bruce was tall in stature, of large size, and an athletic form, but well proportioned. He was familiar with most of the modern and ancient languages, and possessed great facility in acquiring them. He was an excellent draftsman, and had some knowledge of practical astronomy; but he was extremely deficient in natural history. A little acquaintance with botany and mineralogy, very essential requisites to every traveller, would have given a great additional value to his descriptions.

When Mr Bruce's work appeared, it was violently assailed from all quarters, and it was even asserted that he had never been in Abyssinia, and that the book was a gross fabrication. Succeeding travellers, some of whom were little disposed to support Mr Bruce's credit, have involuntarily confirmed all those statements which excited wonder, and were even disbelieved when first made. To one objection, the account which he gives of his prediction of an eclipse, the time of which by some strange mistake refers to Britain, no answer we believe was ever made. The story indeed seems to be taken from a similar occurrence which happened to Columbus the great discoverer of the New World.

BRUCKER, John James, author of a history of philosophy, was a native of Swabia in Germany, and was born at Augsburg in 1696, studied at the university of Jena, where he employed himself for some time in the capacity of a private teacher; and having entered the clerical profession, he was appointed in 1740 senior minister of his native city, which was his fixed residence for the last 30 years of his life. He died in the year 1770, at the age of 74.

Brucker was the author of various works connected with literature and philosophy; but he is chiefly known by his critical history of philosophy which was first published at Leipsic in 1744, in five quarto volumes, and in an improved and enlarged edition, in six volumes, a short time before his death. This work, which is peculiarly characterised by the profound researches, great industry, and sound judgment of the author, contains a biographical sketch of ancient and modern philosophers, and a critical examination of their systems and doctrines. An abridged translation of it, by Doctor Enfield, was published in London in 1790, in two volumes quarto.

BRUGES, a city of the Netherlands, stands in a fine plain, about eight miles distant from the sea; is spacious and well built, and about a league and a half in circumference. Of its public buildings, the most conspicuous are the stadthouse, in the great market-place, remarkable for its lofty tower, which is at first square, and is surmounted by another of an octagon form, and carried nearly to the same height; the cathedral, an ancient massy edifice; and the church of Notre Dame, which is an elegant building, and its lofty spires form an excellent land-mark to ships which approach Ostend. Two magnificent tombs of gilt copper are erected in this church; and it is said that the robes of Thomas a'Becket, ornamented with precious stones, are preserved in the treasury. Hospitals and schools are numerous; and the provisions for widows and orphans is liberal and abundant.

Bruges, in the 13th and 14th centuries, was the greatest commercial city in Europe, and formed a kind of central station between the northern and southern nations; and in consequence of this prosperous trade it acquired opulence and grandeur. But its decline was not less rapid; the citizens rebelled against the archduke Maximilian, their sovereign, who, with the assistance of the rival cities of Antwerp and Amsterdam, cut off their communication with the ocean, and destroyed their trade. Dreading more disastrous consequences, the citizens submitted to the clemency of their prince; a heavy fine was imposed on the city; many of the inhabitants were banished, and more than 50 were condemned to suffer death. From this severe visitation, which happened in 1487, it has never yet recovered. In the year 1430, the order of the Golden Fleece was instituted at this place by Philip the Good, duke of Burgundy, on the occasion of his marriage with a princess of Portugal; and the property of this order, denominated *Franc of Bruges*, included a number of villages, to which important privileges were attached.

The inhabitants of Bruges, the number of which is stated at 35,000, are occupied in the manufacture of woollen stuffs, fine linens, cotton cloth, and laces, equal to those of Mechlin. Corn, and seeds for making oil, are exported in considerable quantities; and its commercial intercourse is still respectable; by means of canal and river navigation, the communication with other towns in Flanders is greatly facilitated. Vessels of 400 tons are brought to the middle of the city. Bruges is eight miles distant from Ostend, 24 miles N. E. from Ghent, and 46 miles west from Antwerp.

BRUN, Charles le, a celebrated French painter, and descended from a Scotch family, it is supposed of the name of Brown, was born in 1619, and at the early age of four discovered a strong predilection for drawing, with no other materials than coals from the hearth; and in his 12th year produced a portrait of his grandfather, which was greatly admired. In his 23d year he visited Italy; and for six years, under the tuition of the famous Poussin, and under the same roof with that artist, he studied the principles, and laboured with unremitting assiduity to improve himself in the practice of his profession. In his 30th year he returned to Paris, and was fortunate in obtaining the friendship of the minister, Colbert, and, through him, the munificent patronage of Louis XIV. who was not more distinguished by ambition, than by his liberal encouragement of the fine arts. Nominated first painter to the king, raised to the rank of nobility, and intrusted with the superintendence of the royal works, he was at last placed at the head of the academy of painting, and had the merit of extending the facilities of improvement in the art, by establishing a school at Rome for the gratuitous instruction of his countrymen. Le Brun seems to have been one of those characters who are extremely jealous of reputation, and are feelingly alive to the danger of competition. The removal of his friend, Colbert, from the superintendence of the royal edifices, and the appointment of his successor, who brought forward a rival to the artist, greatly disturbed his repose in the close of life, and, indeed, it is said, were the means of shortening the period of his existence. He died in 1690, when he had reached the 71st year of his age.

As a painter, Le Brun was distinguished by the grandeur of his designs, in the execution of which he has preserved the utmost historical propriety, just arrangement, and accurate expression; but, in colouring, drapery, and ornament, he has been less successful. His most celebrated pictures are, the battles of Alexander, the engravings of which, by Gerard Audran, have conferred almost an equal degree of celebrity on that artist; St John in the isle of Patmos; the crucifixion; and the penitent Magdalene; and, among other productions of his pencil, may be mentioned the allegorical representation of the chief events of the reign of Louis XIV. in the great gallery at Versailles. He was the author of a treatise on physiognomy, and another on the passions, which is illustrated with figures.

BRUNN, or BRINN, a city of Moravia, and capital of a circle of the same name, is finely situated on two mountains at the confluence of the rivers Schwartschaw and Surtawa, and is remarkable for the splendour and elegance of its churches and other public buildings. The sides of the hills on which it is built are covered with gardens and vineyards; the population is stated at 16,000; the principal manufactures are silk-stuffs, velvets, cloth, and hats; and it has the advantage of four annual fairs.

BRUNSWICK, a city of Lower Saxony in Germany, and capital of a duchy of the same name, was formerly an imperial city, one of the richest of the Hanse-towns, and the residence of the reigning duke, till it was annexed to the kingdom of Westphalia during the progress of the French revolution. It stands on a fine plain on the banks of the Ocker, a navigable river; is of a square form, about two miles in circumference, and strongly fortified. The ramparts are furnished with a brass-mortar of enormous magnitude; it is ten and a-half feet long, and is more than three feet in diameter; and, with a charge of 52 lbs. of powder, it throws a ball of 730 lbs. weight a distance of 33,000 paces, according to one account, and, according to another, 33,000 toises,—a statement not more incredible than remarkable for the looseness with which it is made, particularly when it is considered that the distance of 33,000 toises is equal to 38 miles. The houses in general are old, and a large proportion of them is constructed of wood; but some of the public edifices are not destitute of magnificence,—as the palace of the duke, which is furnished with a valuable collection of objects in natural history, many excellent pictures and prints, and extensive library, which is enriched by many scarce and curious bibles; the cathedral, which is adorned with some splendid monuments; several churches; the military academy; and schools and colleges for teaching the various branches of medical science.

The population of Brunswick, which has fluctuated greatly in different periods of its history, exceeds 30,000. The manufactures of linen, silk, and woollen stuffs, iron, paper, and earthen-ware, some of which were introduced by French refugees, who found an asylum in this place from religious persecution, and whom the wisdom of government encouraged, by granting them many essential privileges. Printed calico has been long a flourishing manufacture, as well as alum and sal ammoniac, which are produced of an excellent quality. *Mum*, a kind of strong beer, which derives its name from a person called Mummer, who first made it, is celebrated in many parts of Europe, to which it is exported. The invention of the spinning-wheel in 1530, is ascribed to a native of Brunswick, and a statuary by profession. Two great fairs are annually held in this place, and each is continued for 18 days, and is crowded with strangers from the chief cities of Germany, who exchange the various productions of other countries for the manufactures of the town and its vicinity. The trade in flax, yarn, and green thread is very considerable.

Brunswick, before the incursions of the French into Germany, was the capital of a duchy of the same name, and the residence of the duke of Brunswick Wolfenbuttle, who was despoiled of his territories, and fell in an action with the army of the invaders.

BRUNSWICK, New, a province of North America, and one of the four which belongs to Great Britain; is bounded on the east and south-east by the gulf of St Lawrence and the bay of Fundy; on the south by New England; and on the north and west by Canada. It is well watered with numerous rivers, some of which are navigable, clothed with extensive forests of pine, birch, maple, elm, and other timber, and enriched, especially in the interior, with a fertile and moderate soil. The numerous harbours on the coast, afford every convenience to the trade and fisheries. The sea coast abounds with various kinds of fish; it is frequented by immense shoals of herrings, and cod are very abundant. This province was settled by loyalists in 1783, after the conclusion of the American war, and in a very short time enjoyed a lucrative trade in fish and timber with the British West India islands. The privileges granted to the United States to embark in the same trade, were unfavourable to the inhabitants of New Brunswick, who could not enter into competition with equal advantages. Beside timber to a considerable extent, which is floated down the rivers to the shipping places, horses, salted provisions, and butter, are enumerated among the exports.

BRUNTISLAND, or Burntisland, a royal borough in the county of Fife in Scotland, occupies a peninsular situation on the north side of the frith of Forth, nearly opposite to Leith, consists chiefly of a single street which is pretty spacious, and has one of the most secure and commodious harbours on the coast. In former times, Bruntisland was deemed a place of importance; it was fortified by the French during the eventful period in 1560, resisted the attack of Oliver Cromwell till he agreed to certain stipulations to improve the streets and harbour, and was taken by the rebels in 1715. The remains of walls and entrenchments, constructed for its defence, are yet visible.

The population is about 2000. The trade, before the union of the kingdoms, was considerable; the herring fishery in the Forth revived the declining prosperity of the place; a large distillery and some chemical manufactories have been established; ship-building is extensively conducted, and a spacious and commodious dry dock is capable of admitting the largest frigates.

BRUSSELS, a city of the Netherlands, stands in a fertile country on the banks of the river Senne, dates its origin in the seventeenth century, and is indebted for its commencement to a bishop of Cambray, by whose piety a chapel was erected; the inhabitants of the surrounding country were attracted to the spot, and in the course of two centuries it increased to a considerable village; was first inclosed with a wall in the eleventh century; and towards the end of the fourteenth, the fortifications, as they now appear, were constructed. It became afterwards the residence of the dukes of Brabant, at a later period the seat of the Austrian governors, sustained various changes of fortune during the continental wars, and is now the capital of the kingdom of the Netherlands.

Brussels is regarded as one of the finest towns on the continent; it is defended by a double brick wall, which is about seven miles in circumference, is furnished with seven gates, and is surrounded with extensive and populous suburbs. The older streets, and those in the lower part of the town, are narrow and crooked; but those of a modern date are spacious and elegant. The palace of the former dukes, and the usual residence of the governors, occupies an elegant situation with a spacious square in front, which is adorned with brazen pillars, surmounted by statues of emperors and dukes. This splendid structure was begun in the thirteenth century, and was not completed till the commencement of the sixteenth. The Hotel de Ville, a magnificent Gothic structure, with a spire of curious architecture, 364 feet high, and surmounted by a statue of St Michael with the dragon, in gilt copper, stands in the great market-place. The internal decorations of this splendid edifice correspond with its external magnificence. Some of the apartments are adorned with beautiful specimens of tapestry, representing the history of the resignation of Charles V. Many of the churches and palaces of the nobility are elegant structures, and most of them are richly decorated with the finest paintings, by some of the first masters of the Flemish school. Of twenty public fountains which supply the city with water, some of them are elegantly executed, and richly embellished.

The population of Brussels, of which the visitations of war, to which it has been so often subjected, has produced great variations, is stated at more than 70,000. It has been long celebrated for its manufactures. Brussels lace and Brussels carpets, always denote something of superior beauty and excellence. Woollen and cotton stuffs, silk stockings, gold and silver lace, earthen ware, and the preparation of potash, are also enumerated among its manufactories. The trade of Brussels was at one time considerable; and at an annual fair held in October, which was attended by merchants from all parts of Europe, very extensive commercial transactions were effected.

Brussels was the head quarters of the British troops on the eve of the memorable battle of Waterloo; and, both before and after that decisive victory, presented a scene of the deepest interest, not merely to its anxious inhabitants, who were fearfully apprehensive of the dreadful fate that awaited them in case of disaster, but to every nation and country of Europe, all of whom were more or less remotely concerned in the issue of the contest. But that important period of its history is still fresh in recollection; and the numerous tours, sentimental, descriptive, or of a mixed character, which the vanity or industry of its visitants has presented to the public, furnish ample materials to render the city and surrounding scenery as familiar to readers as any town and district of their own country.

BRUTE, the general appellation of those classes of animals which are either destitute of the powers of reason, or, possessing them in a lower degree, are comparatively considered inferior to man. The discrimination of the faculties, by the operation of which the various races of living beings are guided in their actions and pursuits, and the attempts to establish a distinction between the mental powers of man and the analagous principles of the inferior orders of animals, have been the fertile sources of speculative discussion in all ages. By some it is maintained, that the capacities of brute animals are not only different from the powers of man in degree, but are also of a different nature; but according to another opinion, these powers are of the same kind, and differ only in degree. Many of the difficulties which have attended this discussion might probably vanish by stricter attention to correct definitions of the terms employed, and particularly to the precise meaning of the words reason and instinct, of which the former is appropriated to the human faculties, and the latter is applied to the active principles of the inferior animals. The distinction between the reasoning powers of man and the instincts of the lower animals, proposed by Dr Reid, may help to settle this question, or at least may mark the difference between the human race and other animals. According to that cautious philosopher, the improvements, which are the result of the reasoning powers of man, are communicated and received by others, and transmitted, with all their advantages, to future generations; but however nearly the instinctive habits of some animals may approach to the rational capacities of mankind, no effort of ingenuity induced by any change of circumstances or mode of life passes from one individual to another, or is communicated to their posterity. It can scarcely be doubted, that passions and emotions of a character similar to those which agitate the human breast operate powerfully on many of the lower animals; but the observations of naturalists have discovered in them no traces of moral capacity or religious feeling, no indications of a clear perception of virtuous actions, or of veneration for a supreme being, a sentiment universally impressed on the human mind; and this remarkable diversity of mental or intellectual capacity affords another striking distinction between the powers of the human race and the lower orders of animals.

BRUTON, or Brewton, a town of Somersetshire, stands in a pleasant situation near the head of the river Brew, and is a place of considerable antiquity, as appears from the date of its free school, almshouse, and other public edifices. The population exceeds 1600; and stockings, coarse woollen stuffs, and silk throwing, by means of machinery, are the only manufactures.

BRUYERE, John de la, a French writer, who was born about the year 1664 and died in the year 1696, and of whom little is recorded, excepting that he was the author of a singular production, in which, under the general title of *Characters*, he describes the manners of his age, in imitation of Theophrastus. On this work Voltaire has pronounced the following critique: "The characters of Bruyere," he says, "may justly be ranked among the extraordinary productions of this age. Antiquity furnishes no examples of such a work. A style rapid, concise, and nervous; expression animated and picturesque; an use of language altogether new, without offending against its established rules, struck the public at first, and the allusions which are crowded in almost every page, completed its success. When La Bruyere shewed his work in manuscript to Malesieux, this last told him, that the book would have many readers, and its author many enemies. It somewhat sunk in the opinion of men when that whole generation, whose follies it attacked, were passed away; yet, as it contains many things applicable to all times and places, it is more than probable that it will never be forgotten."

BRYANT, Jacob, a profound English scholar, and writer on mythology, was born at Plymouth in 1715, received the first elements of his education at a provincial school in Kent, was instructed in classical literature at Eton, and prosecuted the higher branches of learning at King's college, Cambridge. He was afterwards employed as private tutor to the eldest son of the duke of Marlborough, aud in that capacity accompanied his noble pupil to Eton. In 1756 he was appointed private secretary to the duke of Marlborough, who was then at the head of the forces in Germany, and he attended the commander-in-chief on the continent. By the influence of the duke, who was master-general of the ordnance, he was nominated, on his return, to a lucrative place in that department. This appointment not only afforded him that leisure and competency which are so desirable to a literary man, but brought him that affluence which enabled him to appear with respectability in an extensive circle of literary friends and persons of distinction. The greater portion of Mr Bryant's long life was marked by studious and retired habits. His residence was chiefly in the vicinity of Windsor; and his mild manners, elegant conversation, and extensive knowledge, rendered him an agreeable companion in the most polished society. He lived to his 89th year, and died in 1804. He bequeathed his valuable library to King's college, Cambridge, the liberal sum of L.1000 to the Society for the Propagation of the Gospel, and L.1000 to the superannuated collegers of Eton.

The works of Bryant furnish undoubted evidence of profound erudition and unwearied industry; and his labours were chiefly directed to the elucidation of classical literature or scripture history. His treatise on *Ancient Mythology* is acknowledged to be his most elaborate production; and the last work in which he was engaged, and to which his thoughts had been directed for 30 years of his life, is entitled, *Dissertations on Various Subjects in the Old Testament*; but the classical reader may perhaps be surprised, that the same person who vindicated the authenticity of the poems published by Chatterton, and ascribed to Thomas Rowley, has attempted to prove in another work, that no such city as Troy existed in Phrygia, and, consequently, that the history of the Trojan war is an invention of the Greek poet.

BRYONIA, Bryony, a genus of plants belonging to the class Monœcia, and of which one species, *Dioica* or *Alba*, Red-berry Bryony, is a native of England.

BUCCANEERS, an appellation originally applied to the French settlers in the island of St Domingo, who lived by hunting wild cattle; but it was afterwards extended to a set of piratical adventurers, composed of English and French, who associated for the purpose of making depredations on the Spaniards of

America. The name is said to be derived from a practice of the indigenous inhabitants of the Caribbee islands, of roasting the prisoners of war over a fire. The operation was called *boucaner*, to roast and smoke; and as the hunters practised the same thing on animals killed in the chace, they were denominated Buccaneers. The success of the Spaniards in obtaining possession of the West Indies and continent of America, and the riches which they acquired, excited the avarice of other nations, especially the English and French, to come in for a share of the booty. The jealousy of the Spaniards was alarmed, and a settlement of the French in St Christophers was driven from that island. Thus disappointed, some of the fugitives retired to the northern shores of St Domingo, which were then uninhabited, and fully stocked with countless numbers of wild cattle and hogs. Along with some English and Dutch adventurers, they took possession of those parts of the island, and devoted themselves to the hunting of those animals. Some of them became planters, and many turned pirates, and obtained the name of freebooters. The riches which these piratical adventurers obtained, and distributed among their associates, drew numbers from Europe, who joined them in the character of indented servants: And thus the colony was composed of four classes; the buccaneers, or hunters, the planters, the free-booters, or pirates, and the indented servants. The planters settled chiefly in the small island of Tortuga, on the northern coast of St Domingo; but, during the absence of some of them in the latter island, the rest were surprised by the Spaniards and put to death. An attempt was next made to drive the buccaneers from St Domingo; and the greater part of the cattle being destroyed by the Spaniards, some of the hunters joined the French settlement on the coast, and others united themselves to the freebooters, who then became a powerful body.

The piratical adventurers who arose among the buccaneers, formed themselves into small parties of 50, 100, or 150 men each, and, with vessels of different sizes, directed their depredations, at least in the first period of their career of plunder, chiefly against the Spaniards; but afterwards, from choice or necessity, made a prey of the property of other nations. Their attacks were not confined to the rich ships of the Spaniards returning to Europe, but were extended, as their numbers and audacity increased, to their settlements both on the east and west shores of South America, and in many cases they carried off immense plunder. The buccaneers flourished during the 17th century, and, as a proof of their power and influence, 1200 of them joined a French fleet sent from Europe to attack Carthagena; and, by their valour and exertions, the city was taken, and booty obtained to the value of a million and a-half Sterling; but the avidity of the commander offered them little more than L.5000 as their share of the spoil. It was rejected with disdain; they returned to the city, and entered it without resistance; shut up all the men in the great church, and demanded payment of L.218,750 as their share of the prize-money; but as the sum collected fell short, the city was plundered. Returning loaded with wealth, the buccaneers fell in with a fleet of English and Dutch ships, who were then in alliance with Spain; several of the pirates were taken or sunk, the rest escaped to St Domingo, and this was the last memorable event in their extraordinary history. Of these adventurers it has been remarked, that without any regular system, without laws, and without any fixed revenue, they became the astonishment of the age in which they lived, as they will be also of posterity. See Edward's *History of the West Indies*; Raynal's *History of the East and West Indies*; *History of the Buccaneers of America*, by J. Esquemeling.

BUCCINUM, or WHELK, a genus of testaceous animals, belonging to the order of Univalves, and of which several species are natives of Britain. See CONCHOLOGY.

BUCENTAUR, a large galley, belonging to the state of Venice, which was finely adorned with pillars, splendidly gilt, and furnished with a covering of purple silk. In this vessel the doge received the great lords and persons of quality who visited Venice, accompanied by the ambassadors, counsellors of state, and senators; and the same vessel was employed on Ascension-day, in the magnificent ceremony of espousing the sea, by throwing a ring into it, as a symbolical expression of the dominion of the Venetians over the gulf.

BUCER, MARTIN, a learned German, and one of the early promoters of the Reformation, was born about the year 1491; assumed the religious habit of St Dominic while in his 7th year; but his future inquiries and conversation with Luther excited doubts concerning the Romish faith, and led him at last to join the reformers. He assisted at many conferences on religious matters, and was present at Augsburg, where he subscribed the agreement between the papists and protestants, called the *Interim*. Exposed to severe persecution in his own country, he was invited into England by archbishop Cranmer, and appointed to teach theology at Cambridge, where he died in 1551, and was buried with great funeral pomp. Five years afterwards, and in the succeeding reign, when the fury of persecution reached the dead, his body was dug up and publicly burnt, and his tomb destroyed; but it was again repaired by the order of queen Elizabeth.

BUCHANAN, GEORGE, a Scottish poet and historian, celebrated for the elegance and purity of the Latin language, which he usually employed in his writings, was a native of the parish of Killearn in Stirlingshire, and was born in the year 1506. On the death of his father, who was a small farmer, the charge of a young family of five sons and three daughters devolved to his widow, who was left in a state of great poverty. George, it is said, received the elementary part of his education at the public school of his native parish; and through the kindness and liberality of James Heriot, his maternal uncle, he was sent, in his 14th year, to the university of Paris, where he improved his knowledge of the Latin language, began the study of Greek by his own industry alone, and first discovered his talents for poetry. Two years had scarcely elapsed when the death of his uncle threw him friendless on the world, and at the very time when he was afflicted

Buchanan. with severe indisposition. He returned to Scotland, and his health being restored, he entered the army, and spent about a year in active warfare in England. But his constitution was unequal to the hardships of a military life, which hurt his health and threw him on a sick-bed for several months. About the end of his 18th year he entered the university of St Andrew's, and in 1525 was admitted to the degree of bachelor of arts; soon after became a student in the Scotch college at Paris; was afterwards appointed a professor in the college of St Barbe, and taught grammar for three years. In 1532 he had the good fortune to be appointed tutor to the earl of Cassillis; and after five years residence in France, he returned with that young nobleman to Scotland.

The inquiries in which Buchanan had been engaged, and the intercourse which he held with learned men who were attached to the reformed religion, led him to adopt their sentiments and opinions, and made him little scrupulous of exposing the dissolute conduct of some of the members of the Romish church. The publication of a satirical poem, after his return to his native country, in which he reflected on the Franciscan friars, excited the obloquy and resentment of that order, and determined him, to elude their threatened vengeance, to take refuge in France. But the appointment of preceptor to James Stuart retained him in the country till the publication of his *Franciscanus*, in which the ignorance and vices of the same order are still more fully exposed and treated with ridicule, brought him into immediate danger, and obliged him to make a precipitate retreat to London, and afterwards to Paris. The relentless persecution which he dreaded from cardinal Beaton, who was then ambassador at the French court from Scotland, drove him from Paris to seek an asylum in the college of Guienne at Bourdeaux, where he was nominated professor of the Latin language, was happy in the society of some of the most eminent scholars of the time, and in the course of three years wrote his translations of two tragedies of Euripides, and two original compositions of the same character, the subjects of which are taken from scripture history.

After a residence of three years at Bourdeaux, Buchanan returned to Paris, where he was employed as a professor in the college of cardinal le Moine, and had for his associates Turnebus and Muretus, two of the most learned men of the age. About this time the university of Coimbra was established in Portugal, and the reputation of Buchanan, through the recommendation of his friend, Andrew Govea, whom he had formerly known at Paris, procured for him an invitation to take a share in the management of that seminary; but the unexpected death of Govea left him exposed to the intolerance and persecution of religious bigotry. He was charged with heretical practices, summoned before the inquisition, and with a lenity not usual with the decrees of that dread tribunal, was only sentenced to confinement in a monastery. The period of his imprisonment was one of the most important in the literary life of Buchanan; for, during that time, he composed his version of the Psalms, a task, it is said, imposed upon him by the monks to whose charge he was intrusted, either as a punishment, or as evidence of the soundness of his faith. But whether the labour of this beautiful composition was imposed upon him by others, or was the spontaneous effort of his own genius, the purity of its style, and the elegance of its language, have raised the author to the first rank of Latin poets in modern times.

Having regained his liberty, he turned his thoughts to France, which was always his favourite residence, and which on this occasion he eulogises in a fine strain of panegyric, and delineates, with all the embellishments of poetry, the beauties of the country, and the refined manners, distinguished valour, and liberal arts of the people. Several years of his life were at this time spent in France, either in the capacity of a public teacher in some of the seminaries of Paris, or as a private tutor in a noble family. But the flames of civil war again drove him from the French territory, and obliged him to revisit his native soil. When he returned to Scotland the reformed religion had been sanctioned by a parliamentary enactment, and he now declared himself a professed adherent of the new doctrines.

The learning, prudence, and respectable character of Buchanan, pointed him out to Queen Mary as a fit person to superintend the education of her son. At an earlier period, he had assisted the studies of that unfortunate princess in classical literature, and the dedication of his version of the Psalms, in an elegant poetical address, shews that he either enjoyed or courted royal favour. Mary in her turn was not unmindful in rewarding his merits. She conferred on him the temporalities of the rich abbey of Crossregal in Ayrshire; and he was nominated principal of St Leonard's college in St Andrews, till the young prince should arrive at a proper age to benefit by his instructions. At a future period of his life he held the office of director in chancery and lord privy-seal; and to retain his services and influence in her interest, he enjoyed from queen Elizabeth a pension of L.100 a-year. Having joined the party which opposed the views and conduct of the ill-fated Mary, Buchanan produced a work, entitled the *Detection*, which, it is said, was written at the suggestion of the regent Murray, and which is read with sentiments of censure or applause, according to the view which is adopted of the strange transactions to which it alludes. He accompanied the same nobleman on an embassy to the court of Elizabeth, on the affairs of the Scottish queen, who was then prisoner in England. In 1579 appeared a celebrated work, in which he discusses some of the principles of government; it is entitled *De Jure Regni apud Scotos Dialogus*, and is dedicated to his royal pupil; and in his 74th year he composed a Biographical Sketch of himself, which is not more distinguished by elegance of language than modesty and candour of sentiment. The last twelve years of his life were devoted to the preparation of his History of Scotland, a production which is advantageously compared with the best Roman writers for its classical purity and elegance, but which has not escaped the charge of partiality, and an undue attachment to the detail of fabulous events. While this celebrated work was in the press, the author was seized with his last illness, and he died in

September 1582, when he had reached the 77th year of his age. His body was committed to the earth in the burying-ground of the Greyfriars; but no memorial remains of the spot where his ashes repose,—no stone marks the place of his dust. An obelisk, 100 feet in height, which was erected in 1788, at Killearn, points out to the traveller the place of this great scholar's nativity.

Throughout his works Buchanan exhibits himself the resolute enemy of tyranny and usurpation, and the steady friend of the liberties of mankind. His happy genius, as the historian of the period in which he lived finely expresses it, equally formed to excel in prose and verse,—more various, more original and elegant than that of any other modern who writes in Latin, reflects, with regard to this particular, the greatest lustre on his country.

The best editions of the collected works of Buchanan are one which was printed at Edinburgh in 1704, in 2 vols. folio, and another in 2 vols. 4to, revised by the learned Burman, and published at Leyden in 1725. See *Memoirs of the Life and Writings of Buchanan*, by Dr Irving.

BUCHARA, or Bokhara, a city of Great Bucharia, in Asia, is situated on an elevated spot on the banks of the river Sogd, and is about 100 miles westward from Samarcand. The city is divided into three quarters, of which the khan, or governor and his court, occupy one; his officers and servants another; and the third, the most extensive, is assigned to the merchants and other inhabitants; and in this last subdivision, every particular trade has its own department. The houses are low, and generally composed of mud; but the public buildings, such as the mosques and baths, are constructed of more substantial materials. In an early period of its history, Buchara was celebrated for its university, to which students crowded from all parts of the Mahometan dominions, to be instructed in the various branches of literature.

Buchara was famous for fine linens in the 10th century; but its chief manufactures, in modern times, are cotton stuffs, printed calico, and soap. Its favourable situation for trade, raised it to great commercial importance, and it became an emporium for the exchange of the productions and commodities of the east, for those of the western parts of Asia and Europe. But since the subjection of the country to the Usbeck Tartars, it has greatly declined, and its commerce has languished under injudicious and oppressive exactions.

BUCHAREST, or Buchorest, a town of Wallachia, in European Turkey, stands on the river Damboriza, and is the residence of the prince or governor of the province, and the see of a Greek archbishop. The houses, which have in general a mean appearance, are spread over a great extent of surface, and may be considered as a collection of villages, distributed without any regular plan. The streets have a singular appearance from being paved with planks of wood laid transversely, and when this unusual pavement begins to decay, walking becomes extremely incommodious. The number of convents and churches is said to be not fewer than 400, and some of them are elegantly constructed in the Greek style. The palace of the Hospodar, or governor, is a low building of wood, destitute of elegance. The population of Bucharest is stated at 60,000. The surrounding country possesses a fertile soil, affords excellent pasturage, and abounds in corn and wine, from which are derived the chief commodities of their trade, which consists in the exportation of provisions to Constantinople. At different periods subject to the Russians, the Austrians, and the Turks, Bucharest came under the dominion of the latter power in 1791, and has since continued to acknowledge the authority of the Ottoman porte. It is about 250 miles N. W. from Constantinople.

BUCHARIA, or Bocharia, Great, a country of independent Tartary, which is bounded on the north by the river Sirr, and on the south by a chain of mountains which form the limits with Persia and Hindostan, and on the east by a chain which separates it from Little Bucharia. This country is supposed to include the Sogdiana and Bactria of the ancients; it lies between 35° and 43° of north latitude, and 59° and 73° of east longitude, and comprehends the kingdoms of Samarcand, Balk, and Bucharia properly so called. It presents an agreeable variety of surface; the mountainous ridges are extensive and lofty; and the plains are copiously watered by the Amu or Jihon, which is the Oxus of the ancients, and the Sirr or Sihon, both of which discharge their waters into the lake Aral, the latter after a course of 350 miles, and the former after having run nearly 900 miles. The climate is favourable, and the soil is said to be the richest in northern Asia. Corn and rice are cultivated in some places, but the most fertile parts of the country are always in pasture, on which is reared a prodigious number of sheep and horses. Of horses, it is said that 10,000, and of sheep 60,000, are annually sold at Orenburg in Russia. The mountains furnish some metallic ores, and even some of the precious metals have been discovered.

The inhabitants of this country consist of three distinct nations, the Buchars who are the native race, the Moguls, and the Usbeck Tartars to whom it is now subject. The first, or the Buchars, are quiet and mild in their manners, compose the chief population of the towns and villages, and are entirely devoted to trade and commerce; but the other two tribes of inhabitants are of a robust and warlike character, delight in martial exercises, and are rarely disengaged from feuds and hostilities with the Persians. The Tartars are governed by khans, to whom the native inhabitants pay an annual tribute. The original race of the Buchars enjoy the greater part of the trade, and carry on an extensive commercial intercourse with China, Russia, and Tibet.

BUCHARIA, Little, a country of Asia, which was formerly known under the denomination of the kingdom of Cashgar, and is supposed to include part of ancient Scythia. Inferior in the nature of its soil, its climate, population, and the number of its cities, it is distinguished by the title of Little; but not because it is less extensive than the country on the west which has a similar appellation. The Altaian mountains form the boundary on the north, the empire of China is on the east, and a chain of mountains marks the line of separation with Tibet on the south. Included between the 36 and 44° of north latitude, and the 70 and 88° of north longitude, it is about a thousand miles in length, and nearly 500 miles at its greatest breadth. It is nearly surrounded with lofty mountains and sandy desarts. The soil is generally barren and unproductive; but in some of the fertile vallies, cotton, hemp, flax, vines, and different fruits, are abundant and excellent. The inhabitants, in their manner and dress, resemble those of Great Bucharia; and their chief trade is with China, Persia, and the northern parts of Asia.

BUCKING, the first operation in bleaching, or the preliminary process in preparing cloth for being whitened. See Bleaching.

BUCKINGHAMSHIRE, an inland county of England, is bounded on the north and east by the counties of Northampton, Bedford, Hertford, and Middlesex, and on the south and west by Berkshire and a part of Surrey, from which it is separated by the river Thames. The name is supposed to be derived from a Saxon word, in allusion to the beech trees with which the country was covered, or, according to others, from bucks or deer which once abounded in its forests. The Chiltern hills, which consist chiefly of chalk, occupy the southern districts of the county; but the northern division is finely diversified with eminences of moderate elevation. The chief rivers are the Ouse and the Thames. The length of the county is about 45 miles, and the breadth about 18 miles, including more than 518,000 acres, of which more than two-thirds are arable.

The population of this county in 1811 exceeded 117,000. It is divided into eight hundreds and 185 parishes, with 15 market-towns, of which Buckingham and Aylesbury are county towns. Some of the nobility and gentry have splendid residences in this county, among which the magnificent mansion and spacious grounds of Stowe, belonging to the marquis of Buckingham, are the most conspicuous.

The soil of the county is chiefly of rich loam, strong clay, or chalky. Grain is produced in the Chiltern district, but a small portion only of the northern division is arable. The vale of Aylesbury, in the centre of the county, has been long proverbial for its fertility, and affords a rich pasture to great numbers of cattle. The dairy is the chief object of attention in some parts of the county, and a large quantity of butter is annually made for the supply of the London market. The rearing of calves and of young ducks, the latter of which, by particular management, are brought forward about Christmas for the supply of the same market, are also much attended to.

Lace and paper are the chief manufactures, in the former of which almost all the females of the lower classes are employed. The manufacture of paper is in the vicinity of Wycombe, and on the small river of the same name fifteen corn and paper-mills have been erected; cotton spinning has been established; and wooden vessels and utensils of turnery ware are made at Chesham. The trade is greatly facilitated by the grand junction canal, and by smaller branches which traverse the county.

Some remains of Roman antiquity have been discovered in this county, among which are enumerated coins, and vessels, and particularly a fine tesselated pavement of about nine feet square, the borders of which are beautifully ornamented with small square stones of different colours, and the centre is occupied with the figure of an animal. This pavement was found in the neighbourhood of Wycombe.

BUCKINGHAM, Town of, is the chief town of the county of the same name, stands on the banks of the river Ouse, and is washed on three sides by that stream, consists of one long street, and the houses, which are chiefly of brick, are scattered over a large space. The church, a modern edifice, on an elevated spot, and adorned with a square tower, which is surmounted with an elegant spire, and the town hall, are the principal public buildings. The population exceeds 2600, and the inhabitants are chiefly occupied in the labours of agriculture, and in the manufacture of fine black and white thread lace.

BUDA, the capital of the circle of Pest, and the chief city of Hungary, stands on an elevated spot on the west bank of the Danube, is the *Acinium* of the Romans, and on the opposite bank of the river is Pest, the *Contra-Acinium*, with which a communication is formed by means of a bridge of boats. Buda is called Offen by the inhabitants, and in conjunction with the opposite town of Pest, is generally described as one place. It has neither walls nor gates, but is defended by a castle on the eastern extremity. The suburbs, which are occupied by Jews, have the name of Jews-town. When Buda was the seat of royalty, it was the finest city of Hungary; but under the dominion of the Turks, who held it during the long period of 150 years, it fell to decay, and mosques and minarets took the place of some of the principal churches. The caravanseras and mosques are still reckoned among the principal buildings; but the most magnificent edifices are the warm baths, which have been long famous, and places of great resort. Pest is surrounded with a wall and moat, and the royal palace, a spacious edifice, the military hospital, some convents and churches, are the principal buildings. The university is the first learned institution in the kingdom, and more than thirty teachers are established for giving lectures in divinity, philosophy, and medicine.

Buda is the chief commercial city in the kingdom. The productions of the soil and of national industry are the principal exports, among which are enumerated grain, tobacco, brandy, potash, honey, wax, and the famous Tokay wine. The fair of Pest, which is attended by Greeks, Jews, and Armenians, and lasts for ten days, is the greatest in Hungary. The population of Buda exceeds 20,000 inhabitants, and that of Pest is from 25,000 to 30,000.

Buda was the residence of the Hungarian monarchs till the year 1410, when Sigismund was raised to the imperial throne of Germany. After several times changing masters, it finally came under the dominion of the Austrians, and continued in their possession till 1686. The public offices which had been established at Presburgh, were transferred to Buda in 1784, and gave a considerable accession of wealth and population. Buda is 125 miles S. E. from Vienna.

BUDISSIN, or Bautzen, the capital of Upper Lusatia in Saxony, stands on the river Spree, and was founded by a duke of Bohemia in the 8th century, was formerly an imperial city, but lost its privileges when it fell under the dominion of the king of Bohemia. The manufacture of woollen stuffs, linen, and stockings is extensive, and the printing of linen and cotton cloths, with the preparation of glazed leather, furnishes employment to many of the inhabitants.

BUENA VISTA, or BONAVISTA, one of the Cape de Verd islands, on the west coast of Africa, and in north latitude 15° 56′, derives its name from the fine appearance which it presents to those who approach it from sea; is about 20 leagues in circumference, and is particularly distinguished on its northern boundary by a remarkable ridge of white rocks.

BUENOS AYRES, a viceroyalty of the Spanish dominions in South America, is bounded on the north by Brasil and Amazonia; on the east by Brasil and the Atlantic ocean; on the south by Patagonia, and large tracts of country still imperfectly known; and on the west by Chili and Peru. The area within these boundaries is from north to south about 1600 miles long, and from east to west more than 100 miles broad; and comprehends the provinces of Rio de la Plata, Paraguay, Tucuman, Los Charcos, and Cuyo.

External aspect.—This extensive region exhibits, on a great scale, a series of the more prominent physical features impressed on the earth. A majestic river, which expands to the breadth of 150 miles, and rolls vast volumes of water into the Atlantic, is, at no great comparative distance from its mouth, ramified into several noble branches, which penetrate far into the frontier mountains, and which collect and carry off the floods of rain that frequently falls upon them. From the banks of these rivers, the country expands into wide and trackless plains, waving in one place with luxuriant grass—where innumerable flocks and herds roam unconfined, and where game of many sorts find their food, and their shelter; in another place they are covered with impenetrable forests of gigantic growth, the retreats of birds, and the lurking place of wild beasts; here a hollow basin, hundreds of miles in circumference, becomes an azure lake, or a reedy marsh, which harbours noisome reptiles, and exhales pestiferous vapours; there stupendous mountains, white with eternal snow, or red with blazing volcanoes, lift their heads above the clouds. Thus the sublime mountains, the majestic streams, and the expansive plains of Buenos Ayres, present a scene of unparalleled magnificence, in comparison of which the corresponding objects of other regions dwindle into insignificance.

Mountains.—Except where this vast amphitheatre opens to the ocean, it is surrounded by lofty cordilleras, of which the stupendous Andes traverse its upper provinces. From the principal ridges on the western frontier, a lateral branch stretches eastward between the territories of the Portuguese and the Spaniards, and contains the sources of the great rivers which cross and divide the countries both of Brasil and of Buenos Ayres. A similar ramification in the direction of the river Colorada forms the southern frontier, and a variety of intermediate chains, of which the mountains of Cordova and Achala are most conspicuous, extend through the province of Tucuman.

Rivers.—From these mountains a thousand streams descend, and, having traversed the interior part of the country in all directions, unite in one immense estuary, which is distinguished by the name of the Rio de la Plata, and which affords a magnificent approach to the inland provinces. In tracing the Rio de la Plata upward from the ocean along its northern bank, the Uraguay is the first great river which swells its waters. This river rises in the Sierra de St Catherine mountains, which wall the southern coast of Brasil, and thence, in a channel of a thousand miles in length, flows toward the Rio de la Plata. At its mouth it is four miles broad, but in many places of its course it spreads out to double that extent. The right bank of this river is steep and rocky, but the left is low and marshy; it is increased by many tributary streams, and is navigable to Yupoya where it is obstructed by a fall. Above the mouth of the Uraguay, the Rio de la Plata bends towards the north, and assumes the name of the Paraguay, the sources of which are traced to the Diamond mountains of Brasil. The water of this river, while it flows among the mountains, is highly transparent, but, being impregnated with a saline substance, it has a nauseous taste. This salt matter deposits an incrustation on the roots of the trees on the margin, which gives them the appearance of rock-work. Having received the Cipotuva, the Cabacal, and the Jaura, the Paraguay leaves the mountains and enters the great flooded savannahs. The Parana, which is the eastern and the greater branch of the Paraguay, flows also from the mountains of Brasil; at the place where it enters the Cordillera de Maacayu, it is 2100 fathoms broad, nearly a sea league, and very deep; but the mountains contract it so suddenly to a channel of thirty fathoms, and in these straits the whole body of water falls more than fifty feet at an angle of fifty degrees. The sound of this tremendous cataract is heard to the distance of six leagues, and a cloud of vapour rises to an immense height, and falls in a perpetual shower. The fish are of different species above and below the fall, and thence to the mouth of the Yuguazu, a distance of thirty-three leagues, its course exhibits a constant succession of rapids and whirlpools. The rich savannahs on the banks of this river are scarcely habitable; for they are subject to two inundations in the course of the year, and beyond the flooded country there is no water at all, or water so bad as to be unfit for use. These great rivers, as they flow in their courses, are joined by innumerable smaller streams; of these, the Pitcomayo, the Vermejo, the Salado, which flows into the Paraguay from the west, deserve particular notice. The Saladillo, after traversing the southern plains of the province of Buenos Ayres, loses itself in the great bay formed by the Rio de la Plata. The Rio Colorado, denominated at different parts of its course also the Desaguodora, the Mendozo, &c. has its source among the mountains bordering on Chili, and its mouth on the north side of cape Lobos, and may be regarded as the natural boundary of the viceroyalty on the south.

Lakes.—The physical causes, of which, in other regions, lakes are the effect, operate here with a power proportioned to the influence necessary to produce stagnate surfaces of water of a magnitude sufficient to correspond with the other objects which diversify the face of the country. The pent up vallies become the reservoirs of the torrents which furrow the face of the surrounding mountains; or the rivers overflow their banks, and lodge their waters in the hollow places of the neighbouring plains. Lakes formed in both these ways abound throughout Buenos Ayres. The mountain vallies of the province of Cuyo, Los Charcos, and the upper parts of those of Tucuman and Paraguay, are thickly interspersed with lakes of the former description; of these the lake Titicaca, situated among the Andes, in the province of Los Charcos, exhibits the most magnificent aspect. It is about 240 miles in circumference, and from 70 to 80 fathoms in depth; it presents an irregular outline, deeply indented by capes and creeks; its waters are brackish and muddy, but its banks are finely diversified, and extremely fertile; many picturesque islands are scattered on its surface, over one of which stood the most splendid of the Inca temples. The lake Xarayes spreads over an immense surface, between the 16th and 18th degrees of south latitude. This wide space is flooded by the inundations of the river Paraguay, and is alternately an inaccessible marsh, and a navigable sea. The lake Iberi lies between the Uraguay and the Parana, and is said to be formed by a filtration of the waters of this latter river through the sand of which the subsoil is composed. Besides these lakes, the Aguaracaty, the Ypoa, the Neembucu, the Mandiha, the Yapacarary, and a multitude of others, are found expanding from the river courses after they have reached the great plains.

Climate.—The geographical position, and the diversified surface of this country, indicate much difference of temperature. The ordinary summer heat of the plains which approach nearest to the equator, is from 85° to 100° of Fahrenheit's thermometer placed in the shade, and that in the coldest months in winter it is seldom seen below 45°, while in the same latitude the mountains ascend sublimely far above the region of perpetual frost, where

> Thron'd in his palace of cerulean ice,
> There Winter holds his unrejoicing court,
> And through his airy hall the loud misrule
> Of driving tempests is for ever heard.

In the sloping declivities of these snow capped mountains every gradation of temperature, from the extreme cold of the summits above to the oppressive heat of the plains below, is experienced at short intervals. The excessive evaporation perpetually going on from the lakes, rivers, and forests, loads the atmosphere with humid vapours which, in many cases, prove injurious to the health of the inhabitants, render the houses extremely damp, and generate the most terrific storms. Amid the violent raging of these storms, the appalling glare of livid lightning extends over the horizon, the awful peal incessantly rolls in the heavens, and the tremendous thunderbolt deals destruction to every object exposed to its terrible influence. Hurricanes are said to be of rare occurrence, and it is said, at the same time, that the gales which frequently sweep over the Pampas plains, carry with them clouds of dust so dense and dark as to intercept the light of the sun, and that they blow with a violence which makes it necessary to use mica, instead of glass, in the windows of the houses in the towns of Paraguay. These south winds, as also those which blow from the east, lower the temperature, and generally usher in the annual rains. Yet, notwithstanding these circumstances, which, indeed, are confined to particular spots, or to particular periods, the climate of this country is, on the whole, one of the most delightful in the world. Such is its kindliness, that the salubrious amenity of the atmosphere at first suggested the name *Buenos Ayres*, or *fine air*, which the principal city and the country at large still retain; and the surprising energy of vegetation, the unparalleled fecundity of animal existence, as well as the health and longevity of its inhabitants, prove the appellation to have been properly applied.

Minerals.—The mountains which surround, or which traverse this country, are constructed chiefly of primitive rocks, and accumulations of volcanic scoria. These mighty masses are rich beyond all parallel in beds of useful fossils, and in veins of metallic ores. The plains below the western mountains are completely saturated with common salt, to the enormous extent of 700 miles in length, and nearly 200 in breadth. The greater part of this saline region is interspersed with numerous and extensive lakes full of strong brine, and lined with a thick incrustation of solid salt; in many places of the tract, too, this substance is found in a dense efflorescence upon the surface. Great quantities of this valuable mineral are collected and purified on the spot, and thence conveyed to the cities and towns of the vice-royalty.

Mines of gold, silver, &c.—But this country is still more distinguished for its metallic ores than for its saline productions. According to Helms, who, from the records of the chancery, constructed a table of the mines now worked in the vice-royalty, there are at present open in it 30 mines of gold, 27 of silver, 7 of copper, 9 of lead, and 2 of tin. Grains of gold are found in many of the river courses; of which the sand of the river Vermejo, and that of a stream near the Indian town Mexos are peculiarly rich. A productive mine of this precious metal is now open in the district of Monte Video. But the mines of Cochabamba and Sicasica are the richest. The mountains of both these districts, especially the last, contain much ore, and numerous pieces of pure gold. Large masses are said to have been found formerly adhering to the solid rock, and still lumps weighing several ounces, are washed down by the rains. Many of the gold mines of this region have been abandoned, because it is thought they are already exhausted; but as they have been unskilfully wrought, it is still probable that, if they should ever be re-opened under better auspices, a lucrative gleaning, and even immense treasures, may be obtained from them.

Silver mines.—Helms tells us that twenty-seven mines of silver are worked in the viceroyalty. But as more than three-fourths of the produce of these mines is derived from Potosi, the mines of that mountain only deserve particular notice. The mountain of Potosi is at its base about twenty miles in circumference, and rises in a conical form to the height of 4000 feet above the surface of the circumjacent plains; it is composed chiefly of yellow coloured argillaceous slate, traversed by veins of ferruginous quartz, through which a rich silver ore is interspersed. This ore is of various colours, arising from the minerals with which it happens to be associated; it is black, brown, grey, red, or green, and is mixed with lead, iron, or copper. This rich mine is said to have been accidently discovered by Diego Hualpa, an Indian, while hunting the chamoy; in ascending the rugged steeps in pursuit of his game, he happened to pull up a shrub, and saw with surprise that it had grown in a silver soil. The discovery of the immense treasures of Potosi, though kept secret for a time, was soon after revealed to the Spaniards, and in 1545 entered in the public registers. And from that time till now, these mines have yielded a large proportion of the silver which has been imported from South America. From 1545 to 1556, no official records of their produce were kept. Ulloa conjectures, that, during these eleven years, L.144,000,000 Sterling were obtained from them. But Humboldt diminishes this enormous amount to the more credible sum of L.26,328,125; and subsequently to this period down to the year 1789, this intelligent traveller, calculating from the duties paid into the royal treasury, was enabled to exhibit a correct view of the riches obtained from these celebrated mines; which, according to his statement, amounts to the great sum total of L.318,543,935 Sterling. Helms reprobates, in severe terms, the unskilful manner in which the silver is extracted from the mines. The leaden hammer of twenty pounds weight exhausts, he says, the strength of the miner, the iron tools are of an incommodious length; and, the thick tallow candles, wrapt round with wool, vitiate the air. He also censures severely the expensive and inadequate process in use for purifying the rude ore.

Metallic iron.—A remarkable mass of native iron in the province of Tucuman has been described by travellers. It is extremely hard, but pure, ductile, and malleable, and is supposed to be about fifteen hundred weight. Conjecture has in vain laboured to account for the origin of this metallic mass. That it has been thrown from a volcano,—created on the spot where it lies,—or has fallen from the clouds,—are opinions which have been successively propagated respecting it. But now that similar masses are known to exist in other parts of the world, it is generally thought to have had a meteoric origin, and ought to be classed with those bodies which, from time to time, have fallen from the atmosphere.

Vegetables.—The influence of a genial climate upon a fertile soil, encourages in this country a profuse and vigorous vegetation; so that the astonishing variety, and the gigantic growth of the herbs, plants, and trees, which adorn and diversify the landscapes of Buenos Ayres, are scarcely equalled by those of the richest regions of the earth. The pastures, in at least three of its provinces, are of an unparalleled extent, and of unequalled luxuriance. Tobacco, cotton, maize, pepper, ginger, sarsaparilla, are indigenous to the soil. The corn, pulse, garden-herbs, and fruit trees of Europe, attain in this climate to their highest perfection, and might be extensively cultivated with certain success. Vast tracts of the country are covered with forests of everlasting verdure, among which is the lofty and elegant palm-tree, the Jesuit's bark tree, numerous dye woods, and excellent timber for all manner of useful and ornamental cabinet-work. But the tea, or herb of Paraguay, which is the most celebrated of the peculiar vegetable productions of the viceroyalty, and which in Spanish America is in great demand, is properly the foliage of a tree called Caa by the natives, resembles the orange-tree, but of larger growth, and with softer leaves, and its white flowers grow in small clusters. The mode of preparation is various. The greatest quantity is cured by laying small leafy twigs of the tree before a fire, or suspended over it, till the leaves are dried; then they are laid on the ground, and beaten with small rods, till both leaf and stalk are pulverized. This is called *Yerva de Palos.* A finer sort, called Caa miri, is made by picking out the stalks and larger fibres of the leaves, slowly roasting the soft part of the foliage, and finally beating it in a wooden mortar. In both these processes, care must be taken not to over-roast the leaves, lest they should be deprived of their gumminess and flavour. This powder is infused like tea, and drunk by all classes throughout South America. The trees from which it is prepared, and which belong to the genus *Ilex*, grow chiefly in the woods, about two hundred leagues east from Assumption, in a marshy, muddy soil.

Animals.—Zoology has been greatly enriched and extended since the discovery of the western world; and of the animals with which naturalists have thereby become acquainted, many are natives of the viceroyalty of Buenos Ayres. This is the country of the *Puma*, a beast of prey akin to the lion, but far less ferocious; the jaguar, and the cougar, which in form and habits resemble the tyger of the east; the tamandua, or ant-eater, and the sarigue, which lives on insects, eggs, and mice; foxes, wolves, and hyænas; pole-cats, martins, and ferrets, still more mischievous than those of Europe, are common. Among the animals may also be enumerated the lama, a species of camel, and equally docile and patient; the paco, highly prized for the silky fineness of its fleece, and the tapir, the American hippopotamus, or river-horse. So congenial also has this country proved to the nature of the European cow, and horse, sheep, deer, and goat, that since their introduction they have increased with such astonishing rapidity as now to traverse the face of the country with unrestrained freedom, and in countless and unclaimed myriads. Hogs, hares, and rabbits are also very numerous. Of the infinite variety of its birds, the emu, a species of ostrich, bred in the Pampas plains, and the condor, the most formidable of the vulture race, are the most peculiar to the climate. Turtles, seals, and sea-lions frequent the shores of the ocean; alligators of large size, and an infinite variety of fishes, inhabit the rivers; serpents, among which is the enormous boa constrictor, and an endless variety of insects and reptiles swarm throughout the country, though chiefly in the forests, and among the marshes.

Population.—The population of Buenos Ayres has been variously stated. Some have computed the amount of Spaniards and Creoles, exclusive of Indians, at one million; but according to Humboldt, the whole is about 1,100,000, although he thinks the estimate is not very correct. The inhabitants are divided into four classes, the European Spaniards, and the Creoles, or Spaniards born in America; the Mulattoes and Mestizos, or people of colour; the negroes or Africans; and the Indians, or original inhabitants of the country. The European Spaniards hold the first rank, fill the chief offices of trust, and are the most industrious and wealthiest part of the community. Many of the Creoles are those descended from native Spaniards, possess valuable estates, which they inherit from their forefathers; but they are, in general, an indolent and luxurious race, averse to all habits of mental exertion or active industry.

The Mulattoes and Mestizos, of which the former is the offspring of a white and a negro, and the latter of a white and an Indian, form a very useful class of the population, and are chiefly employed in the mechanic arts, retail trades, and other active labours, which the pride or indolence of those of the higher classes precludes them from undertaking. The third class of inhabitants consists of negroes who have been imported from Africa, and are in a state of slavery. Many of them are employed in the household and domestic establishments of the Spaniards; and it is said, that those who are doomed to labours of a severer kind, experience kinder and more humane treatment than the same unfortunate race in some other American colonies. The Indians constitute the fourth class of the inhabitants, who, from the first invasion of the Spaniards down to the present time, have been subjected by their cruel taskmasters to severe bondage and great oppressions. These cruelties and severities, indeed, at one time threatening to exterminate the whole population, called for the interference of the Spanish court, by whom many laws and regulations were made, to prevent the evils to which the poor natives were exposed, and to protect them against the violence of those who inflicted them; and in many respects, it is said, the condition of the Indians is greatly improved; but still they are liable to oppressive tyranny and arbitrary exactions, for they are compelled to certain kinds of labour, as in the erection of public buildings, making roads, and working mines. Many of the Indian tribes have never been brought under subjection to the Spaniards. Some of them are of a warlike character, and live chiefly by plunder; others are engaged in agriculture, and have some intercourse with the Spanish settlements, bartering the productions of their country for European commodities.

Commerce.—Beside the precious metals, hides, tallow, wool, furs, wood, and drugs, particularly Jesuits bark, form part of the exports to the mother-country; in return for which, they receive those productions of European industry which are necessary for the supply of the colony. The trade between Buenos Ayres and the western regions of South America, as Peru, Chili, and Lima, is also considerable, as well as with the Havannah, and the coast of Africa.

Civil establishment.—The viceroy is the representative of the Spanish monarch, has all the power and dignity of a sovereign prince, and exercises the supreme authority in all departments of the state. The nomination of the viceroy is generally for three years; but the period of his government is sometimes extended, if he happen to command influence at the Spanish court; and although the legal salary is not large, yet opportunities are not wanting, if he have the inclination, to accumulate, in a very short time, an immense fortune. To the royal audiences of Buenos Ayres and Los Charcos, the cognisance of all civil and criminal causes is committed; and in actions not exceeding 10,000 piastres in value, their sentence is final; but in causes concerning property of large amount, an appeal may be carried before the royal council of the Indies in Spain. The same tribunals possess the privilege of remonstrating against the political regulations of the viceroy, which regard questions of civil right, and of laying the matter before the council of the Indies. To each province is appointed a governor, who is under the jurisdiction of the viceroy; and subordinate to the governors are numerous orders and denominations of magistrates. The jealousy of the mother-country of her American colonies, and her anxious endeavours to prevent fraud in remote provinces, have greatly encumbered every department of domestic police and finance with numerous tribunals and officers. The ecclesiastical establishment of Buenos Ayres is kept up with great splendour.

Discovery and conquest.—Brazil was accidentally discovered by the Portuguese in 1500; in the succeeding year Americus Vespucius sailed as far south as the 52° of latitude; but the severe weather compelled him to return to Europe without making any important discovery; and in 1516, Dias De Solis, a Spanish navigator, entered the Rio de la Plata, and sailed along its northern shore; but having incautiously landed, was massacred by the Indians. Another Spanish navigator, Sebastian Cabot, was commissioned by Charles V. to sail round the world; and in the progress of his voyage he anchored in Rio de Solis, the name which it then bore; he proceeded far into the interior, and built a fort on the Parana; and seeing the natives have ornaments of gold and silver, he changed the name of the river to Rio de la Plata, or River of Silver. Cabot dispatched a ship to Spain, where the news of his discoveries were received with great satisfaction, and an armament for the conquest of the country was ordered to be fitted out. But disappointed of reinforcements for two years, he returned to Spain, and left a garrison of more than one hundred men in the fort, which was soon after attacked, and the whole of the Spaniards were massacred. Another armament under Pedro de Mendoza, arrived in South America in 1535, and founded the city of Buenos Ayres on the south bank of the river. After various struggles with the Indians, he and his successors extended their conquests, established new colonies, and built cities. The Jesuits made their appearance in this part of South America about the end of the 16th century, and were highly instrumental, by their address and perseverance, in conciliating the Indians, whom they were afterwards permitted to collect together into townships independent of the Spanish

Buenos Ayres.

establishments, and only acknowledging the sovereignty of the king of Spain. To protect themselves against violence, they were empowered to embody and arm their Indian converts in the European manner.

A settlement on the north bank of the Rio de la Plata, which was planned and attempted by the Portuguese, excited the jealousy of the Spaniards, and produced many disputes and struggles, until it was finally ceded in 1778 to the latter. But the prosperity and growing power of the Jesuits at last attracted the attention of the court of Spain, and the revolt of some of those tribes which had been under their authority greatly diminished their influence; for it had been alleged that the Jesuits had encouraged and aided the opposition of these tribes to the dominion of Portugal, to whom they had been assigned by a treaty between Spain and that power. The expulsion of the Jesuits from Spain in 1767 was naturally followed by the loss of their influence in the New World.

An expedition, fitted out by the British, under general Beresford and Sir Home Popham, arrived in June 1806, and, after a slight opposition, entered Buenos Ayres, and obtained a rich booty in specie and colonial produce; but the Spaniards having collected reinforcements, retook the city in August following; and the strong post of Maldonado, at the mouth of the La Plata, was all that remained in possession of the British force. With the hope of being able to secure a wide field of commercial intercourse, a strong reinforcement was dispatched from this country, and Monte Video was taken by storm; and for the reduction of Buenos Ayres, another expedition, under general Whitelocke, arrived at Monte Video in May 1807, and soon after proceeded against the capital. But the unfortunate issue of that attempt, through the misconduct of the commander, who was cashiered by the sentence of a court-martial, disappointed the hopes of the country, and finally terminated in an armistice and convention, in which it was agreed that the British should evacuate the Rio de la Plata.

The distractions which prevailed in the mother-country extended their influence to this valuable colony. Anxious to extend and establish his authority, Bonaparte had sent emissaries throughout the American colonies; but a revolution took place in the government of the settlement in 1810; a junta was appointed in Buenos Ayres, and Ferdinand VII. was acknowledged. The regency of Spain appointed a viceroy; and when he arrived to take possession of the government, the junta refused to submit to his authority, and seemed disposed to throw off their dependence on the mother-country until Ferdinand should be restored. But the viceroy succeeded in gaining a party in Monte Video to second his views, and the inhabitants of that town declared for the regency. To compel the junta of Buenos Ayres to the same submission, hostilities commenced; and although an accommodation was attempted, and in some degree succeeded at the time, the scanty resources of the feeble power of the parent state may not soon be able to recover its lost authority.

BUENOS AYRES, the capital of the viceroyalty of the same name in South America, stands on the south bank of the Rio de la Plata; became the principal town of the province in 1620, and greatly increased in wealth and population, when it was made the seat of the vice-regal government in 1778. It is regularly built; the houses are chiefly of brick; the chief streets are spacious and elegant; and the principal square has the fort, which includes the viceroy's palace and a royal chapel on one side, the town hall on the opposite side, and the cathedral, a magnificent structure, on the west side. Four monasteries, several hospitals and churches, some of which are not destitute of elegance, are also enumerated among the public buildings. Many of the houses are surrounded with gardens, and are fitted with balconies and lattice works, for the reception of ornamental shrubs and flowers. The suburbs, occupied by negroes and mestizos, are not remarkable for cleanliness. For several leagues in the vicinity of the city, the country is well cultivated, and presents a rich and diversified scene of gardens and corn-fields; and the immense plains which succeed afford pasture to great numbers of wild horses, and large herds of cattle.

The population of Buenos Ayres has been variously stated at 30,000, 40,000, and even as high as 70,000. The trade in which they are engaged has been already alluded to in the account of the viceroyalty. It is subject to much inconvenience from the difficult navigation of the La Plata, and the want of a commodious harbour near the town. No vessels of large burden can approach nearer than the bay of Barragan, which is seven leagues distant. To obviate these inconveniences, Monte Video was established, and this spot was selected on account of its safe and excellent harbour. S. Lat. 34. 36. W. Long. 58. 31.

Buffon.

BUFFON, George Louis le Clerc, Count of, a celebrated French naturalist, was born at Montbard in Burgundy, in 1707, and being destined for the profession of the law, commenced his studies at the college of Dijon; but the mathematical sciences early occupied his attention, to the exclusion of other pursuits. While in his 20th year, he became acquainted with an English nobleman, whom he visited in England, and afterwards accompanied to Italy, where the grand scenes of nature attracted more of his attention and admiration than the most exquisite productions of art.

Succeeding to the ample fortune of his mother, he was raised to that state of affluence and independence which enabled him to pursue, without interruption, those studies to which his future life was devoted. Among his first works presented to the public, were translations of Hales' Vegetable Statics, and Newton's Fluxions, the prefaces of which are distinguished by that splendour of language which formed one of the chief features of his subsequent writings. Some curious experiments on the strength of wood, and the construction of a powerful burning mirror, are also enumerated among the early labours of this philosopher in the physical sciences.

The appointment of M. Buffon, in 1739, to the place of intendant of the royal garden and cabinet, fixed his resolution of devoting himself entirely to the study of natural history; and the first fruits of

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his labours on this subject appeared in 1744, under the title of a Theory of the Earth, which afterwards formed a part of his larger work. The first volume of his Natural History was published in 1749, and was completed at different intervals in fifteen quarto volumes. But in the composition of this work, although a large portion of it is the production of his own genius and industry, he received material assistance from others, and particularly from M. de Monbelliard and the abbé Bexon; and the anatomical description of animals is the work of Daubenton.

Scarcely any thing connected with this eminent naturalist can be deemed unworthy of record, but his method of study and distribution of his time cannot fail to be received with interest. His industry and application were so great that he devoted 14 hours daily to literary labour; he rose early in the morning, usually about five; and even in his younger years, when he did not return from evening parties at Paris till two o'clock in the morning, his servant had express orders not to permit him to remain in bed after that hour. The regulation of his domestic affairs, and the writing of letters, were the first objects of his attention; and when this business was completed, he retired to his studies about six o'clock, in the pavilion called the tower of St Louis, which was erected at the end of his garden, and about a furlong distant from the house. The interior of this mansion, on account of its lofty roof, presented the appearance of a chapel; no books or pictures were to be seen, and an armed chair, and a large wooden escrutoire, were its only pieces of furniture. Within this was another apartment, a small square building, which was adorned with drawings of birds, and other animals, and was the residence of the naturalist during great part of the year. He breakfasted in the pavilion, and this meal consisted of a piece of bread and two glasses of wine, and then indulged himself in an hour's rest. Having resumed his labours, he continued for two hours after breakfast, and then returned to his house. He spent a considerable portion of time at dinner, slept an hour after it, and, after a solitary walk, enjoyed the conversation of his family or guests during the rest of the evening, and about nine o'clock went to bed. Such was the routine of life which he pursued during the long period of fifty years. With a vigorous constitution, he enjoyed excellent health to a late period of life; but in his old age he was often subjected to the most excruciating agony from fits of the stone. He died in the 81st year of his age, and in the month of April 1788. His funeral was attended by a numerous concourse of persons of rank and literary distinction; and it is said that there were not fewer than 20,000 spectators, through which the procession passed. The monument erected to his memory was destroyed during the blind fury of revolutionary frenzy; the leaden coffin in which he was deposited was carried off, and his remains were left exposed to public view. A proposal that his ashes should be consigned to repose in the Pantheon, was rejected by the barbarians of that time as a profanation.

Buffon possessed a commanding figure, his manner was dignified, and his countenance expressive of superior intelligence. He was fond of luxury and magnificence, vain of his talents and writings, and was not scrupulous in bestowing on them his own commendation. His moral and religious character has been properly a subject of censure and regret; but the splendid style of his compositions can never fail to be a subject of admiration.

Buffon left one son, who fell a victim, in 1795, to the revolutionary tribunal.

BUKHARIA, an extensive region of Asia, which is divided into Great and Little. See BUCHARIA.

Bulama.

BULAMA, an island belonging to the Bijuga cluster of islands at the mouth of the Rio Grande, on the western coast of Africa; lies in latitude 11° 8′, and west longitude 14° 50′; is separated from the main land by a channel two miles broad, which forms a good harbour, and is about 20 miles in length, and from 8 to 15 in breadth. The ascent from the sea-shore is gradual, till it terminate in some mountains of considerable elevation in the centre of the island. It is watered by several fine streams, and the soil is remarkable for its fertility. In many places it is clothed with lofty trees; cotton, indigo, coffee, and rice, are enumerated among its indigenous productions; all the rich fruits of tropical regions grow in great profusion; and, from the rich soil and favourable climate, the culture of sugar and tobacco might be highly advantageous. Wild horses and cattle abound in the extensive savannahs; stags, goats, buffaloes, and elephants, are common; doves, guinea-fowls, and other birds of beautiful plumage, appear in great flocks; and the surrounding sea affords plenty of excellent turtle and great variety of fish. The climate, at least to those who have attempted settlements in this island, is far from being salubrious; the rainy season commences in June and terminates in October, and its approach is generally preceded by tornadoes; but they are neither so violent nor so destructive as the hurricanes of the West Indies.

The peculiar position and productions of Bulama, render it a favourable place for a commercial settlement, and with this view it has often attracted the attention of Europeans. When it was visited by the French, in 1669, it had no permanent inhabitants. The Bijugas, a warlike people, who had expelled, after a long and bloody struggle, the Biafaras, the original possessors, only made an annual visit, for the purpose of hunting the elephant and other animals. The French several times projected the establishment of a colony, but the proposal was never executed. In 1792 an attempt was made to establish a colony from England on this island, and the object of those who entered into the scheme was to open up a commercial intercourse with that part of Africa, and to promote the civilization of the inhabitants. The expedition, consisting of three vessels, with 280 souls, men, women, and children on board, arrived at the island in the month of May; the command of the whole was intrusted to captain Dalrymple and a council of 12, who were chiefly officers of the navy, and among them was captain Beaver, who afterwards published the history of the colony. But the settlers meeting with unexpected difficulties, soon became dissatisfied, and a sudden attack of the natives, by which several of the English settlers were killed, threw them into such dejection, that they never recovered from its effects. Part of the colonists left the settlement, and proceeded in one of the ships to Sierra Leone, with the view of returning to England. The remainder, not more than one-third of the original number, placed themselves under captain Beaver, who was determined to remain in the island; but although his prudence, activity, and perseverance in this arduous task have never been surpassed, yet the difficulties with which they had to struggle, and the sickness and disaffection which prevailed, and by desertion or death daily diminished their numbers, produced such despondency, that they determined to return home, and left the island in the end of November 1793; and thus was the benevolent purpose of the association completely frustrated. For a very interesting account of this establishment, see Beaver's *African Memoranda.*

BULB, in certain tribes of plants, is the hybernaculum, or winter residence of the embryo of the future leaves and flower. The bulb is properly considered as analagous to the bud in other kinds of plants, with this difference, that the latter is formed on the stem or branches, but the former is produced under ground. Those who are curious to see the structure of the bulb, may examine that of the tulip, and, by carefully separating the parts, may be gratified with discovering the flower in miniature, but distinctly formed, in the centre and lower part of the bulb, from which the roots proceed.

BULGARIA, Great, a province of Tartary, which forms part of the government of Caucasus, and is subject to Russia; is bounded on the north by the kingdom of Cassan, by Baskiria on the east, the river Samara, which separates it from Astrakan, on the south, and on the west by the Volga. The name is derived from Bulgar, the capital, which is situated near the Volga, and is now reduced to about 100 houses occupied by peasants. Many rivers traverse the province, and discharge their waters into the Volga; and it is said that the mountains abound with valuable minerals.

BULGARIA, Little, a province of the Turkish empire; is bounded on the west by Servia, by the Danube on the north, the Black sea, on the east, and by mount Haemus on the south, by which it is separated from Macedonia and Romania. This province forms part of ancient Mysia, which was overrun by the barbarous tribes from the banks of the Volga, about the close of the seventh century, and from them it received its present name, and rose to the rank of a kingdom. The Romans maintained almost a perpetual struggle with these invaders for several centuries; they became at last subject to the Roman emperors, and for nearly two centuries continued under their authority. But on the decline of the eastern empire they threw off the yoke, and resumed their independence. In the 13th century, being defeated by the king of Hungary, they acknowledged him as their sovereign; and, in the end of the 14th century, they were finally vanquished by Bajazet, and their whole territory was reduced to the state of a Turkish province.

The general aspect of the province is mountainous, but some of the plains and valleys, which are well watered by numerous streams, are remarkable for fertility. Grain of every kind, cattle, horses, wool, silk, hides, iron, wine, wax, tobacco, and the manufacture of morocco-leather, are enumerated as the chief productions of Bulgaria, and furnish the means of a profitable commerce, by means of the navigation of the Danube and the ports on the Black sea. The inhabitants of this province are Christians of the Greek church.

BULL, from the word Bulla, which signifies a seal, is a decree issued by the pope, is analogous to the edicts of temporal princes, and is employed both in matters of justice and of grace. The bull is written in an old gothic character on parchment, and the leaden seal appended to it represents on one side the figures of Peter and Paul, with a cross in the centre, and on the reverse the name of the pope and the year of his pontificate. If the apostolical letter refer to matters of justice, the seal is attached by a hempen cord, but in affairs of grace is suspended by a silken thread. Bulls are granted for the consecration of bishops, the promotion to benefices, and the celebration of jubilees. The bull which is read every year, on Maunday-Thursday, or the day of the Lord's supper, in the pope's presence, contains execrations against heretics, and all who disturb or oppose the authority of the holy see; and, to denote the thunder of this anathema, the pope, after the reading is concluded, throws a flaming torch on the ground.

An edict issued by the emperor Charles IV. in 1356, and which is regarded as the fundamental law of the German empire, is called the *golden bull*, because the seal is of gold. It contains thirty articles, which fix the number, and regulate the functions, rights, and privileges of the electors. The original, which is written in the Latin language on vellum, is preserved at Frankfort. The *Caroline* bull, issued in 1359 by the same emperor, cancels all regulations to the prejudice of the clergy, made either by himself or by any of his predecessors.

BULLA, the Dipper, a genus of shell-fish belonging to the order Univalves, and of which several species are natives of Britain. See Conchology.

BULL-FIGHTING, is a kind of entertainment which has been common in many nations, and particularly among the Spaniards at the present day. Bull-fighting was practised among the Greeks; but it is doubted whether it was known among the Romans, who were familiar with combats of wild beasts. The Spaniards derived it from the Moors, among whom it was celebrated with great splendour and ceremony. The practice has been prohibited by some popes; but the attachment to this sport has been too strong to eradicate it entirely, and therefore it has been permitted by royal and ecclesiastical authority.

The pomp, the ceremonies, and the danger which attended these exhibitions are finely delineated by Mr Gibbon, in the description of a bull-fight in the *Colisæum* at Rome, in the year 1332, and which he has quoted from Muratori. "A general proclamation as far as Rimini and Ravenna invited the nobles to exercise their skill and courage in this perilous adventure. The Roman ladies were marshalled in three squadrons, and seated in three balconies, which on this day, the 3d of September, were lined with

Bull-fighting scarlet cloth. The fair Jacova di Rovere led the matrons from beyond the Tiber, a pure and native race, who still represent the features and character of antiquity. The remainder of the city was divided between the Colonna and Ursini families: The two factions were proud of the number and beauty of their female bands; the charms of Savella Ursini are mentioned with praise; and the Colonna regretted the absence of the youngest of their house, who had sprained her ancle in the garden of Nero's tower. The lots of the champions were drawn by an old and respectable citizen; and they descended into the arena or pit to encounter the wild bulls on foot, as it should seem, with a single spear. Amidst the crowd our annalist has selected the names, colours, and devices of some of the most conspicuous knights, and several of the names are the most illustrious of Rome and the ecclesiastical state. The colours were adapted to their taste and situation; and the devices are expressive of hope or despair, and breathe the spirit of gallantry and arms. 'I am alone like the youngest of the Horatii,' the confidence of an intrepid stranger; 'I live disconsolate,' a weeping widower; 'I burn under the ashes,' a discreet lover; 'I adore Lavinia or Lucretia,' the ambiguous declaration of a modern passion; 'My faith is as pure,' the motto of a white livery; 'Who is stronger than myself,' of a lion's hide; 'If I am drowned in blood what a pleasant death,' the wish of ferocious courage. The pride or prudence of the Ursini restrained them from the field, which was occupied by three of their hereditary rivals, whose inscriptions denoted the lofty greatness of the Colonna name: 'Though sad I am strong;' 'Strong as I am great;' 'If I fall, (addressing himself to the spectators,) you fall with me;' intimating, says the writer, that while the other families were the subjects of the Vatican, they alone were the supporters of the Capitol. The combats of the amphitheatre were dangerous and bloody. Every champion successively encountered a wild bull; and the victory may be ascribed to the quadruped, since no more than eleven were left on the field, with the loss of nine wounded and eighteen killed on the side of their adversaries. Some of the noblest families might mourn; but the pomp of the funerals in the churches of St John Lateran, and Santa Maria Maggiore, afforded a second holiday to the people. Doubtless it was not in such conflicts that the blood of the Romans should have been shed; yet, in blaming their rashness we are compelled to applaud their gallantry; and the noble volunteers who displayed their magnificence and risked their lives under the balconies of the fair, excite a more generous sympathy than the thousands of captives and malefactors who were reluctantly dragged to the scene of slaughter."

The excessive fondness of the Spaniards for bull-fights is a remarkable feature in their manners, and is hostile to the feelings of other European nations, who are less familiar with such sights. The Spaniards themselves regard this practice as the means of preserving energy of character, and of habituating them to strong emotions, which are only terrible to timid minds. In these sentiments the Spaniards are not singular, for it may be recollected that an enlightened legislator, the late Mr Windham, attempted to defend on the same principles the equally cruel sport of bull-beating in England, when a proposal was made for a legal enactment to suppress that barbarous practice. But although bull-fighting was formerly reckoned among the royal festivals in Spain, attempts have been made, if not entirely to abolish the entertainment, at least to diminish the number of the exhibitions. Bull-fighting

These bull-fights are attended with very considerable expence, but they are also profitable to the undertakers, for the spectators pay for admission as to any other spectacle, and the price of the best and most commodious seats is as high as a dollar. The profits which remain after defraying the expence of the horses and bulls, and the wages of the *torreadores* or combatants, are destined to charitable purposes. In some cities the principal square is fitted up as a kind of theatre for this exhibition.

The spectacle begins with a kind of procession round the square, in which the combatants, either on foot or on horseback, make their appearance; after them two officers of justice in black robes, and of a grave deportment, advance to the president of the spectacle, and request to have an order for the entertainment to commence. A signal is then given, and the animal, which had been previously shut up in a cabin, with a door opening to the square, rushes forward, and is received by the spectators with the loudest acclamations. The *picadores*, or combatants, on horseback, dressed in the ancient Spanish manner, and armed with a long lance, begin the contest; and if the bull, without provocation, dart upon them, a favourable opinion is entertained of his courage; and if, after being wounded and repulsed, he return to the charge, the most enthusiastic expressions of joy are heard; but if he is struck with terror, and seem anxious to avoid his antagonists, he is hooted and hissed by all the spectators, and loaded with reproaches and blows by those who are near him. If after all this his courage cannot be roused, large dogs are let loose against him, and after being torn and mangled, in the estimation of the Spaniards he perishes ignobly. The most animated, as well as the most bloody scene, is exhibited with the combatant on horseback, for the irritated and wounded animal sometimes attacks and overturns both horse and rider; and when the latter is dismounted and disarmed he is protected from immediate danger by the combatants on foot, who endeavour to provoke and divert the bull's attention by shaking before him pieces of cloth of different colours, but in attempting to save the dismounted horseman, they are themselves exposed to great hazard; for the bull sometimes pursues them, when they escape by dropping a piece of coloured stuff, against which the deceived animal exerts all his rage, or, if this resource fail, the combatant springs over a barrier six feet high, which incloses the inner part of the arena. In some places this barrier is double, forming in the intermediate space a circular gallery, behind which the combatant is in safety, but in some cases the barrier is single, and the bull succeeds in his attempt to surmount it, when an indescribable scene of consternation and confusion immediately follows, which proves fatal to many of the spectators, while the unfortunate animal falls under the blows which are levelled at him from all sides.

If the animal is not dispatched by those on horseback, and if he seem disposed to renew the combat, they retire and give place to the *banderilleros*, who are on foot, and presenting themselves before the animal, the moment he darts upon them, plunge into his neck a kind of hook-darts, ornamented with small streamers of coloured paper. The rage of the animal is raised to the highest pitch, and, were it not for the experience and skill of the assailants, his furious efforts would hurl destruction on their heads in a moment. The bull being exhausted with numerous wounds and loss of blood, another victim of barbarous sport is demanded; the signal of death is given by the president, and announced by the sound of trumpets. The matador then appears in the arena, when the other combatants retire. In one hand he holds a long dagger, and with the other waves a flag before his adversary. The interest and pleasure of the spectators, which had been suspended, are again awakened, and the matador, watching the favourable opportunity, inflicts the mortal blow; and if the animal fall, the loudest shouts of acclamation announce the triumph of the conqueror; but if he fail in the first attempt, a murmur of disapprobation pervades the assembly. The fallen animal is then dragged from the arena by three mules ornamented with bells and streamers, and another is immediately introduced to run the same course of barbarous torment. At one period six bulls were thus sacrificed in a morning, and twelve in the afternoon, on the days appropriated to these entertainments in Madrid.

BULLION, is generally defined gold or silver in the mass, or in an uncoined and unwrought state. The same word is used to express these metals in their unalloyed or virgin state; is sometimes applied in a more general sense to gold and silver with every proportion of alloy, and in the British market is understood to be of the British standard; and as gold is the standard metal, the word bullion without addition, refers to gold bullion. According to the British standard, the proportions in a pound of gold are 11 ounces 2 pennyweights of pure metal, and 18 pennyweights of alloy. The exportation of British coin is forbidden by law; but no restrictions are imposed on the trade in foreign coin or bullion. Connected with the suspension of cash payments by the Bank of England, the extensive circulation of paper money, the varying price of bullion in the home and foreign market, and the effect of all these circumstances on the commerce of Britain, no topic has furnished matter for more elaborate parliamentary discussion, or has been the subject of a greater number of pamphlets of different kinds from those who have espoused different sides of the question; and, after all, it must appear obvious, from the very opposite sentiments which have been maintained, that it is not yet well understood, if a subject of so complicated a nature be capable of full and satisfactory elucidation. But to the pamphlets already alluded to, and to the proceedings in parliament, we refer those who wish to render themselves familiar with this intricate subject of political economy.

BUNDELCUND, a spacious district in the province of Allahabad in India, lying between the 24° and 26° of north latitude, and supposed to include 11,000 square miles. The country is high and mountainous, and but imperfectly cultivated. The summits of the hills are chiefly rocky, but they are covered with small copsewood; for timber-trees of a large size are rare. The soil, though not generally, is rich, and produces a number of teak trees, but they are not of a very vigorous growth. Within this district are some diamond mines of great antiquity, and at one time very valuable; but they are now less productive. This territory has been subject to various revolutions, both between its native princes and their neighbours, and the British power in India, and finally, in 1804, became a British district, subordinate to the Benares circuit, and having a civil establishment for the administration of justice and the collection of the revenue appropriated to itself.

BUNYAN, John, the celebrated author of the *Pilgrim's Progress*, was a native of Bedfordshire in England, and was born in the year 1628. Although in the humble situation of a tinker, and perhaps connected with the tribe of gypsies, his father had him taught to read and write; but the son, influenced by evil example, very early indulged in vicious courses, and while yet young, was notorious for every kind of profligacy; but at last he began to reflect seriously on his wicked life, and, with the aid of a powerful imagination, he conceived that he heard a warning voice from heaven declaring his guilt. From this time he reformed his conduct, and having joined a congregation of Baptists at Bedford, became a zealous convert to the profession and practice of religion. He then became the object of severe persecution, was brought to trial for attending conventicles, and condemned to perpetual banishment; and although this sentence was not executed, the unfortunate Bunyan spent the long period of $12\frac{1}{2}$ years in prison; and obtained his enlargement through the kind interference of Dr Barlow, bishop of Lincoln. It would appear that he had delivered religious instruction to a number of dissenters, who were confined in the same prison with himself; and in the last year of his imprisonment he was chosen pastor of the congregation at Bedford. A meeting-house was afterwards built for him, where he preached to crowded audiences. He died in London in 1688, in the 60th year of his age.

No work in the English language has ever obtained a greater share of popularity than the *Pilgrim's Progress*. It is in the form of an allegory, and not more distinguished by its practical utility than by the poetic fancy which it displays in the delineation of striking pictures of life and manners. This work has been translated into most European languages. The *Holy War* is another allegory by the same author; and his whole works have been collected in two vols. folio, embellished with plates, with a recommendatory preface by the celebrated George Whitefield.

BUONAROTTI, Michael Angelo, a celebrated painter, sculptor, and architect, was born in 1474, at Castel Caprese in Tuscany, a fortress in the state of Florence, where his father was governor. His earliest years indicated the tendency of his genius, for when at school he devoted so much time to drawing, Burdor. that other studies were neglected. With no small reluctance his relations yielded to the bent of his inclination, and, although degrading to the dignity of his family, he was permitted to study painting as a profession, and, at the age of fourteen, he was placed as a pupil under Dominico Ghirlandaio, an artist of some eminence. As a proof of the talents of Michael Angelo, it was stipulated, it is said, that the master should pay him an annual salary, instead of receiving a premium from the pupil, as was usual in such cases. About this time the fine arts began to revive in Italy, under the liberal patronage of the munificent family of Medici. The rising genius of Michael Angelo attracted the notice of Lorenzo de Medici, and procured for him a large share of the countenance and friendship of that distinguished prince. Admitted into his house at the early age of fifteen, he enjoyed the high advantage of conversing with men of learning and genius, and of improving his taste by studying the invaluable collections of art at Florence. After the death of Lorenzo, which happened two years after Michael Angelo was received under his roof, the artist remained for some time in the employment of his less worthy and less respected successor, and during this period he executed several works of sculpture.

Bologna, Florence, and Rome, became at different periods the future residence of this extraordinary artist, and still retain splendid examples of his unrivalled productions. Of the efforts of his genius in sculpture, the colossal statue of David, and still more so the statue of Moses, are always noticed and universally admired; the Sistine chapel at Rome, the ceiling of which he adorned with paintings, it is said in the short period of twenty months, and particularly the celebrated picture of the *Last Judgment* in the façade of the same chapel, which was executed at a subsequent period, bear ample evidence of the powers of his pencil, and the promptitude and facility of his execution. The paintings now alluded to are executed in distemper, and doubts are entertained whether at any time he practised oil painting. Of his powers as an architect, the church of St Peter's at Rome exhibits the noblest monument. This splendid structure, begun in 1506, had been under the direction of different artists, who in the progress of the work had deviated from the original plan according to their own views, and had left it an unsightly and discordant pile, when the comprehensive genius of Michael Angelo threw the magic charm of simplicity and harmony over the whole.

In all the departments of art to which Michael Angelo directed the various powers of his mind, he has displayed an originality, energy, and sublimity of conception, which have been rarely equalled, and never surpassed. The peculiarity of his style consists in grandeur and majesty; and to all his characters he has given a kind of elevation above common nature, and a more perfect form than appears in real life. Having reached the venerable age of 90, he died in the year 1563.

BURFORD, a market-town of Oxfordshire in England, stands on a gentle ascent near the river Windrush, and is supposed to be one of the oldest towns of the kingdom of Mercia. The number of inhabitants exceeds 1500, and they are employed in the manufacture of rugs and duffles, but particularly in making saddles, for which this place has been long celebrated. The weekly market is well supplied with grain and cattle, and the horse races on the neighbouring downs attract a great deal of company from Oxford and the surrounding country.

Burger. BURGAGE-TENURE, or tenure in burgage, is when the king or other person is lord of an ancient borough in which the tenements are held by a certain established rent. Boroughs possessing this privilege seem to have undergone no change after the Norman invasion, and therefore this manner of holding is traced to the times of the Saxons; and hence, it is supposed, have arisen the various customs by which property is held under this tenure, and which are most strictly of a feudal nature. In England, 29 boroughs hold by burgage-tenure, and every individual proprietor of a house or tenement possesses the right of voting for burgesses to serve in parliament; and in some of these boroughs the widow has right, by privilege of this tenure, to be endowed not only in a *third*, according to common law, but in the whole of her husband's tenements.

BURGER, Godfrey Augustus, a German poet, was a native of the principality of Halberstadt, and was born in January 1748; shewed no great inclination to serious study till he began to read the Bible, the sentiments and language of which inspired him with enthusiasm, and led him to the first attempts at versification, which were imitations of the psalms. At this time he had scarcely completed his tenth year. Under the tuition of his father, whether it proceeded from a froward and idle disposition, or from want of capacity, he made little progress in the Latin language. In his 12th year he was placed with his grandfather, to afford him an opportunity of attending a public grammar school; but on account of some satirical verses on a schoolfellow, he was removed to Halle in 1762, and two years afterwards he entered into the university of the same place, for the purpose of studying divinity; but the clerical profession, to which he was destined, was ill suited to the dissipated habits which he had acquired. His studies were now directed to jurisprudence, and for this purpose he repaired to Gottingen, where his habits were not improved; but with the assistance of some men of genius, who became his associates and friends, he was enabled to proceed in the more agreeable pursuits of literature and poetry. About the year 1770, Burger began to be known as a poet, in the contributions which he made to the first German poetical almanack, and about the same time he composed his *Ode to Hope*, and the translation of the Vigil of Venus. He retained for some time the office of a magistrate in the neighbourhood of Gottingen; he had also married during this period; but the situation was neither congenial to his disposition, nor the emoluments which it afforded equal to his expensive habits. Returning to Gottingen in 1784, after resigning his office, and labouring under pecuniary embarrassments, he resolved to devote himself entirely to literary pursuits; and aspiring to a professorship, he began to read lectures on belles lettres and philosophy. The death of his second wife, who was the youngest sister of his first wife, and who lived only a few months after the marriage, was a severe affliction to the poet; and from this time, bodily disease and mental distress rendered his future life a scene of poverty and melancholy. A third marriage, the consequence of a romantic attachment, added nothing to his happiness, but in the end was the source of great misery, and was followed by a divorce. After a lingering illness, and being subjected to many severe privations, he died at the early age of 47, in June 1794.

The life of Burger exhibits another example which, it is to be regretted, is not rare in the records of biography, of irregular conduct and depraved habits associated with powerful genius. The works of Burger are characterized by vigour and originality of invention, richness of imagery, energy of language, and harmony of versification. In the composition of his ballads he is peculiarly distinguished. The English reader is familiar with the romantic ballad of *Leonora*, in the translations of Pye, Spencer, Scott, and others, as well as with the *Parson's Daughter Betrayed*, and the *Inhuman Huntsman*, of which also translations have appeared; all of which exhibiting simplicity, pathos, and energy, have acquired great popularity.

BURGESS, in its more general acceptation, is an inhabitant of a borough; but in a more restricted sense, it is applied to the freemen of the borough who have certain privileges of trade, or of practising some mechanical art. The same word is used for the representative of a borough town in parliament, because they are supposed to represent the mercantile or trading interest of the nation.

BURGLARY, or nocturnal house-breaking, by the old English law called *hamesucken*, a word still in use in the law of Scotland, has been always regarded as a crime of the highest nature, and subjected to the severest punishment. The characters which lawyers have given of a burglary are, that it must be committed by night; and, secondly, in a mansion-house; thirdly, by breaking and entering into it; and, fourthly, with a felonious intent. Burglary is a felony in common law, but within the benefit of clergy; and when it is committed in any house belonging to the Plate-glass Company, with intent to steal the stock or utensils, it is declared by statute to be single felony, and punished with transportation for seven years.

BURGOS, an ancient city of Spain, the capital of Old Castile; stands on the declivity of a hill on the bank of the river Arlanzon, and is irregularly built, and surrounded by high walls, which are washed by the waters of the river. The streets are narrow and crooked; but the principal square in the middle of the city is surrounded by piazzas, supported by lofty pillars, and adorned with fine houses. The principal public buildings are, the Hotel de Ville, the palace of Vilaseo, the triumphal Arch erected in honour of the first count of Castile, and particularly the cathedral church, which is regarded as one of the most splendid specimens of Gothic architecture in Spain. This noble edifice, which was begun in the 13th century, is richly embellished with towers, columns, and statues, executed with exquisite delicacy, and all in the finest and best preservation. Some of the chapels are adorned with beautiful paintings by Raphael and Michael Angelo. Some of the other churches are also magnificent structures; as well as some of the convents and hospitals, which are well endowed. A college for the education of youth, and an academy for the polite arts, have been long established, and a school of surgery was instituted in the year 1800.

The population of Burgos is estimated at 9,000; but when it was the seat of royalty it could boast of 40,000 inhabitants, and then its commerce and manufactures were in the most flourishing state. The seat of government was transferred by Charles V. from this place to Madrid, about the beginning of the 17th century. Cloth and fine woollen stockings are now the chief manufactures, and the exportation of the woollen cloths of Castile constitute its only trade. Burgos is 112 miles north from Madrid.

BURGUNDY, a district of France, formerly under the denomination of a province or government, but now divided into the departments of Cote d'Or, Saone, Loire, and Yonne. This district is supposed to have derived its name from the Burgundians, a German nation, by whom it was first established about the commencement of the 5th century. In the progress of its history, it acquired great influence among the states of Europe; and some of its sovereigns, the dukes of Burgundy, were elevated to the throne of France.

The province, between 40 and 50 leagues in length, and about 30 in breadth, is traversed by a mountainous ridge, which extends from Dijon to Lyons; on the east of this ridge a wide and fertile plain is bounded by the mountains of Franche-Compté and Savoy; and on the west the country is hilly and less cultivated; the soil is various, but generally rich; the Seine, the Yonne, the Ain, the Saone, the Rhone, and other large streams, all of which are navigable, are the principal rivers; and the province being traversed by canals, enjoys the advantage of extended inland navigation.

Grain, fruits, tobacco, hemp, and flax, are enumerated among the abundant vegetable productions; the sheep reared in the more elevated parts of the province afford excellent wool, great part of which is manufactured in the country; and the average produce of its wines, some of which are highly esteemed, is stated at 100,000 hhds.

The population exceeds one million, and the inhabitants are employed in the manufacture of woollen stuffs, paper, and delft-ware, in the working of coal mines, and in smelting and manufacturing ores of iron. The chief towns of Burgundy are, Dijon, Auxerre, and Autun.

BURIAL, the interment of a person deceased, has been regarded in all countries as a sacred rite due from the living to the dead, and those who neglected to discharge this debt were supposed to be subject to the wrath of heaven. Among the Greeks and Romans, the performance of the rites of burial to their deceased friends and relatives, was reckoned

Burke. among the most inviolable obligations. Exclusive of that tender feeling which death cannot destroy, and that affectionate regard which reaches beyond the grave, the doctrine entertained by the Greeks and Romans, that the soul could not be admitted into the Elysian fields till the body had received the rites of burial, rendered them extremely attentive to the funeral obsequies of the dead. Those who were denied the rites of burial, were not permitted to enter the mansions of bliss till after the lapse of 100 years; and hence they considered it a duty upon all travellers who should meet with a dead body in the way, to cast three handfuls of dust upon it, one of which was destined to cover the head. The ancients also considered themselves peculiarly unfortunate if their mortal remains were not deposited in the tombs of their ancestors; and, on this account, it was usual to bring the ashes of those who died in foreign countries home, to be interred in the sepulchres of their fathers,—a practice which the pious care of the moderns is still disposed to observe, when it is not opposed by insurmountable difficulties. Among the ancients, some persons were refused the rights of burial, as public or private enemies,—such as betrayed or conspired against their country,—such as were guilty of sacrilege,—tyrants who were regarded as enemies of their country,—such as died in debt, whose bodies were considered the property of their creditors,—and certain offenders who suffered capital punishment. Even of those to whom funeral obsequies were granted, certain marks of disgrace attended their interment,—such as were killed by lightning, were buried in a place by themselves, because they were thought obnoxious to the gods,—those who squandered their patrimony, forfeited the right of being buried in the tombs of their ancestors,—and those who committed self-murder, were privately deposited in the ground without the usual solemnities.

Among the Jews, the rites of burial were denied only to such as were guilty of suicide; and the primitive church observed the same practice with regard to the same description of persons, while at the same time the more solemn funeral obsequies were refused to such as were unbaptized or excommunicated.

The place of burial has been different among different nations. The Jews buried their dead in the town, and the country, on the high-ways, in gardens, and upon mountains. Among the Greeks, the temples were the repositories of the dead in the primitive ages; but, in a later period of the history of that people, as well as of the Romans, and of other heathen nations, it was usual to bury their dead without their cities, and chiefly by the high-ways; and hence the propriety of the ancient monumental inscriptions, beginning with the address *Siste viator*, stop traveller. Among the primitive Christians, burying in cities was not practised for several centuries, nor was it usual to deposit the dead in churches till a much later period. The time of burying the dead, and the ceremonies which are observed during that solemnity, have been very different among different ancient and modern nations.

BURKE, Edmund, a celebrated orator and statesman, was a native of Ireland, and was born in Dublin in 1730, received the early part of his education at a private seminary, under the direction of Abraham Shackleton, a quaker, and became afterwards a student in Trinity college, Dublin. But at this period of his life no indications of great genius had appeared, excepting the publication of some essays of a political nature. He had attached himself particularly to the study of logic and metaphysics, and with these qualifications he offered himself a candidate for the professorship of logic in the university of Glasgow; but another, who it is not understood had so much to recommend him, was preferred. Burke.

After this disappointment he repaired to the metropolis, the great theatre in which the powers of genius are displayed to advantage, and he entered as a student of the Inner Temple; but although he was familiar with the great principles of jurisprudence, it is justly doubted whether his application to municipal researches was ever sufficient to qualify him for the details of legal practice; but the scantiness of his finances, it is well known, required exertion for an immediate supply, and obliged him to labour hard in contributing to the periodical publications of the day. These exercises afforded him an opportunity of acquiring a great command of style and language, and much facility of composition. But his mental exertions injured his health, and having called in the professional assistance of Dr Nugent, a countryman of his own, that gentleman invited and received him to his own house, till his health was restored; and during his residence at this time an attachment to the daughter of his host, who afterwards became his wife, commenced.

The publication of Mr Burke's *Essay on the Sublime and Beautiful* gave great celebrity to his character as a man of letters, and, beside the profits which this work brought him, it is said that he received about L.100 from his father; but great, indeed, must have been his embarrassment, and it is painful to record such an event befalling any literary man, when he was obliged to sell his books. But the work now alluded to introduced him to Sir Joshua Reynolds, Dr Johnson, Dr Goldsmith, and the principal men of letters and celebrity of the day. The *Annual Register*, begun in 1750, was for some time under the superintendence of Mr Burke, and it is said that his contributions to the political and historical departments of that work were the chief source of his emolument while he was engaged in it.

The political life of Mr Burke now commences. Accompanying Mr Hamilton, famous for his single splendid oration in the house of Commons, and hence known by the name of *Single-speech Hamilton*, to Ireland, but without any ostensible situation, he was rewarded with a pension of L.300 a-year, either through the influence of private friendship, or for some secret services. On his return to England he resumed his literary labours; and some essays, which appeared in a periodical publication, attracted the notice of the Marquis of Rockingham, and finally introduced him to that nobleman. He came into parliament in 1765, and it is said that he had acquired the facility of expressing his thoughts in public by frequenting clubs in the metropolis, in one of which, it is added, the powers of Mr Burke found a formidable antagonist in an elo-

Burke.

quent baker, who long annoyed the young orator by his popular declamation. Holding an official situation under the Rockingham administration, he supported the measures of the party; and when a change of ministry followed, he continued strong in opposition to the American war, during the whole period of that disastrous and expensive contest. At the close of lord North's administration in 1782, Mr Burke obtained, among his successors, the lucrative appointment of paymaster of the forces; and while he held an official situation, he introduced and carried his famous bill, which he had at a former period attempted unsuccessfully, for regulating and reducing the expenditure of various public departments. In the succeeding change of ministry, Mr Burke took his place among the ranks of opposition, and assumed a conspicuous station in the discussion of India affairs, and particularly in the famous impeachment of Mr Hastings, of which he was one of the principal leaders, and displayed a power and brilliancy of oratory which has been rarely equalled, and never surpassed either in ancient or modern times. The illness of the king, and the discussion of the regency bill, afforded him another opportunity for the display of his eloquence.

The progress of the French revolution produced a remarkable change in Mr Burke's politics. About the year 1790, he avowed in public that he had abandoned his old friends, and even some of the old principles which he had long maintained. The danger which seemed to threaten all ancient establishments was held out as an apology for this unexpected dereliction. But whatever may have been the cause of his vacillation, the associates with whom he now acted were not slow in rewarding his exertions in support of their measures, by liberal pensions, to the amount of nearly L.4000 a-year, and it was said that a peerage awaited him had he lived; but the death of an only son, who had just commenced his political career, is supposed to have hastened his own. He died at his seat at Beaconsfield, in 1797, when he had reached the 68th year of his age.

The following delineation, which appeared in a celebrated journal, with the exception of a little high colouring, is a pretty correct representation of his character. "Burke was a man of fine fancy and subtle reflection, but not of sound or practical judgment, or of high or rigid principles. As to his understanding, he was certainly not a great philosopher, for his works of mere abstract reasoning are shallow and inefficient; nor a man of sense and business, for, both in counsel and in conduct, he alarmed his friends as much, at least, as his opponents; but he was a keen and accomplished pamphleteer, an ingenious political essayist. He applied the habit of reflection which he had borrowed from his metaphysical studies, but which was not competent to the discovery of any elementary truth in that department, with great facility and success, to the mixed mass of human affairs. He knew more of the political machine than a recluse philosopher; and he speculated more profoundly on its principles and general results than a mere politician. He saw a number of fine distinctions and changeable aspects of things, the good mixed with the ill, and the ill mixed with the good; and, with a sceptical indifference, in which the exercise of his own ingenuity was always the governing principle, suggested various topics to qualify or assist the judgment of others. But, for this very reason, he was little calculated to become a leader or a partizan in any important practical measure; for the habit of his mind would lead him to find out a reason for, or against any thing; and it is not on speculative refinements, (which belong to *every* side of a question,) but on a just estimate of the aggregate mass, and extended combinations of objections and advantages, that he ought to decide or act. Burke had the power of throwing true or false weights into the scales of political casuistry, but no firmness of mind,—or shall we say, honesty enough,—to hold the balance. When he took a side, his vanity or his spleen more frequently gave the casting vote than his judgment; and the fieriness of his zeal was in exact proportion to the levity of his understanding, and the want of conscious sincerity. He was fitted by nature and habit for the studies and labours of the closet, and was generally mischievous when he came out, because the very subtlety of his reasoning, which, left to itself, would have counteracted its own activity, or found its level in the common sense of mankind, became a dangerous engine in the hands of power, which is always eager to make use of the most plausible pretexts to cover the most fatal designs. That which, if applied as a general observation on human affairs, is a valuable truth suggested to the mind, may, when forced into the interested defence of a particular measure or system, become the basest and grossest sophistry. Facts or consequences never stood in the way of this speculative politician. He fitted them to his pre-conceived theories, instead of conforming his theories to them. They were the playthings of his style, the sport of his fancy. They were the straws of which his imagination made a blaze, and were consumed, like straws, in the blaze they had served to kindle. The fine things he said about liberty and humanity, in his speech on the Begum's affairs, told equally well, whether Warren Hastings was a tyrant or not; nor did he care one jot who caused the famine he described, so that he described it in a way to attract admiration. On the same principle, he represents the French priests and nobles, under the old regime, an excellent moral people, very charitable, and very religious, in the teeth of notorious facts—to answer to the handsome things he has got to say in favour of priesthood and nobility in general; and, with similar views, he falsifies the records of our English revolution, and puts an interpretation on the word *abdication*, of which a school-boy would be ashamed. He constructed his whole theory of government, in short, not on rational, but on picturesque and fanciful principles; as if the king's crown were a painted gew-gaw, to be looked at on gala-days; titles an empty sound, to please the ear; and the whole order of society a theatrical procession. His lamentations over the age of chivalry, and his projected crusade to restore it, is about as wise as if any one from reading the Beggar's Opera, should take to picking of pockets, or from admiring the landscapes of Salvator Rosa, should wish to convert the abodes of civilized life into the haunts of wild beasts and banditti. On this principle of false refinement, there is no abuse, nor system of abuse, that does not admit of an easy and triumphant defence; for there is something which a merely speculative inquirer may always find out, good as well as bad in every possible system, the best or the worst; and if we can once get rid of restraints of common sense and honesty, we may easily prove by plausible words, that liberty and slavery, peace and war, plenty and famine, are matters of perfect indifference. *Edin. Rev.*

BURLINGTON, a county of the state of New Jersey in North America, extends between the Delaware and the Atlantic ocean, about 60 miles in length and 30 in breadth, includes about 250,000 acres, of which nearly two-thirds are in a state of improvement, is generally level and well watered, is divided into eleven townships, and contains more than 16,000 inhabitants.

BURLINGTON, the capital of the county of the same name in New Jersey in America, stands on the east bank of the Delaware, and is about three miles long; is chiefly built on an island, from which communications are formed by causeways or bridges with the main-land. The streets are regular and spacious; several churches, an academy, the court-house, and market-houses, are the principal public buildings; the harbour is commodious, and the number of inhabitants exceeds 1000; but, from its vicinity to Philadelphia, the trade is not considerable.

BURNET, Thomas, a learned writer on theology, but better known as the author of a Theory of the Earth, was a native of Yorkshire, studied at Cambridge, and was for some time under the tuition of the celebrated archbishop Tillotson. He was elected master of the Charter-house in London, took orders in the church, and about the year 1680 published his *Sacred Theory of the Earth,* which appeared first in Latin, and is remarkable for the elegance and purity of the style, and was afterwards translated into English; but has been admired more for ingenuity than sound science or correspondence with the details of scripture history. He was the author of several other works, and particularly on the *Faith and Practice of Christians,* and on the *State of the Dead,* &c. also in Latin, and translated; but excepting his Theory of the Earth, none of his writings is much read. He was chaplain and clerk of the closet to king William, but never enjoyed higher promotion, arising, it is supposed, from the unsoundness of his theological opinions. He died in 1715.

BURNET, Gilbert, a learned divine of the church of England, was born at Edinburgh in 1643, was educated at Aberdeen, became a preacher at the early age of 18, and, after prosecuting his theological studies in England and on the continent, he returned to Scotland, was admitted to priests orders, and was appointed to the living of Saltoun in East Lothian; and in a few years afterwards he was nominated professor of divinity at Glasgow, where he was greatly distinguished by his moderation. The rising influence of Dr Burnet made him known to the duke of Lauderdale, who was then at the head of affairs in Scotland, and through him he was introduced to Charles II., who frequently consulted with him in matters of state. Having obtained the favour of the duke of York, he was requested to remain in England; he then resigned his professorship at Glasgow, and was soon after appointed lecturer of St. Clements, and preacher at the Rolls chapel; and about 1697, he published his *History of the Reformation,* for which he received the thanks of both houses of Parliament.

Dr. Burnet had been twice offered a bishopric in Scotland, and again in England he declined the same dignity, because it was trammelled with certain conditions which were incompatible with his sentiments of religious toleration. His well known attachment to the protestant interest rendered his presence in England neither safe nor agreeable, after the accession of James; and having obtained permission he left the kingdom, lived for some time in great retirement at Paris, and having completed an extensive tour on the continent, reached Holland, and was invited by the prince of Orange to the Hague. Admitted to the confidence of the Stadtholder, he became an object of great jealousy to James; and the circulation of single sheets of an *Account of his Travels,* in different parts of England, the object of which was to expose popery and arbitrary power, occasioned a prosecution for high treason to be raised against him, both in England and Scotland; but he avoided the consequences by obtaining a bill of naturalization, in the view of marrying a Dutch lady, his second wife. He was now a subject of the United Provinces, and, it is understood, contributed not a little to promote the design of the prince of Orange in aspiring to the crown of Britain. He accompanied the prince to England in the capacity of chaplain; and, when William was seated on the throne, his services were rewarded with the see of Salisbury. In the succeeding year, he published a pastoral letter on the oaths of allegiance and supremacy. The opinion which he expresses of the right of conquest, by which king William and queen Mary held the sovereignty, gave such offence to both houses of Parliament, that it was ordered to be burned by the hands of the common executioner. *The Exposition of the 39 Articles* appeared in 1699, and excited some investigation in the church courts. He had formed a scheme for augmenting the poor livings, which was finally accomplished by the act of queen Anne; and *The History of his own Times,* left for publication at his death, appeared under the direction of his son in 1723 and 1734, in two volumes folio, and is a curious record of the eventful period to which it alludes. Bishop Burnet died in 1715, and was buried in St. James's, Clerkenwell, where a monument is erected to his memory. This eminent prelate was not more distinguished by his learning and industry, than by his moderation, and the exemplary and faithful discharge of his ministerial functions.

BURNET, James, Lord Monboddo, a celebrated writer on ancient metaphysics, and descended from an ancient family in the north of Scotland, was born in 1714; and being destined for the profession of the law, he was educated at the universities of Aberdeen, Edinburgh, and Leyden, was admitted an advocate at the Scottish bar in 1737, and was promoted to the bench in 1767, when he assumed the title of Lord Monboddo, from the name of his patrimonial estate.

The professional life of Lord Monboddo, either as a lawyer or a judge, was not diversified by many incidents. He was engaged as one of the council in the famous Douglas cause, which at that time excited so much interest; and, by his perseverance, it is said, the present family succeeded in establishing a legal claim to the immense property which was the subject of dispute. But as a man of letters, and particularly as an admirer of the manners and philosophy of the ancients, he is well known to the world. His first publication on the Origin and Progress of Language appeared in 1773, and this work was completed in six volumes, published at different periods. The first volume of his treatise on Ancient Metaphysics appeared in 1778, and the sixth and last on the same subject was presented to the world only a short time before his death. In these works, the strong prepossession of the author in favour of ancient manners and learning, and particularly his admiration of Grecian literature and philosophy, which was excessive, led him into many peculiarities, and have exposed him to the shafts of ridicule, while, in excluding or disregarding the improvements of modern times, he has betrayed the narrowness of his own views. But even with this want of discrimination, his profound skill in ancient languages, and extensive knowledge of ancient philosophy, although little accommodated to the present state of literature, and of no great practical utility, must be readily acknowledged.

The manners of Lord Monboddo partook a little of the same peculiarities which distinguished his sentiments and modes of thinking. Regarding the improvements of modern times as a mark of degeneracy from the hardy character and vigorous habits of the ancients, he declined to indulge himself in many of the accommodations of the age in which he lived. In his annual visits to London he performed the journey on horseback, and continued the practice till he was upwards of 80 years of age. Even in his amusements he imitated the ancients; he was fond of athletic exercises, was accustomed to indulge both in the cold and warm bath, and even practised a mode of anointing the body with a kind of saponaceous mixture. But to his praise it is recorded, that he was temperate in his habits, affectionate in his domestic concerns, a kind and indulgent landlord, an upright judge, and kind and benevolent in his disposition to all. He died at Edinburgh in 1779, when he had reached the 85th year of his age.

BURNING, the process of combustion, or that change which bodies undergo with the extrication of light and heat. See Chemistry.

BURNING THE DEAD, a practice which has prevailed among many nations, both in ancient and modern times. This practice was known among the Jews, was common among the Greeks and Romans, by whom it was observed with much solemnity; and similar ceremonies are described among the customs of the ancient Gauls and Germans; and are familiar among some rude people, as well as among some of the civilized nations of the east in modern times.

BURNING INSTRUMENTS, are instruments constructed on optical principles, by which an intense degree of heat is produced. These instruments are either mirrors or lenses, which concentrate the rays of the sun, either by reflection or refraction. When the effect is produced by reflection, the instrument is denominated catoptric, and by means of refraction it is called dioptric. Powerful instruments of this kind have been known both in ancient and modern times. It is recorded by different ancient authors, that Archimedes set fire to the Roman fleet at the siege of Syracuse, by means of a burning mirror, which, it is said, was composed of small square pieces of glass, moving every way upon hinges, and when placed in the sun's rays directed them upon the Roman fleet, so as to reduce it to ashes at the distance of a bow shot. By means of a similar instrument, constructed by Proclus, the Gothic ships which blockaded Constantinople in the time of Anastasius were destroyed; and a burning mirror on the same principle is supposed to have been constructed by Anthemius, about the end of the 5th century, and in the time of Justinian. But the most celebrated burning mirrors of modern times, were those of Vilette, a French artist; of Tschirnhausen, made of polished copperplate; of the celebrated naturalist Buffon; and of one on an improved construction by Peyrard. Of dioptric burning instruments, the most famous are those of Tschirnhausen, Trudaine, Buffon, and one constructed by Mr Parker of London, at an expence of L.700. This instrument was three feet in diameter, three and a quarter inches thick at the centre, the focal distance six feet, eight inches the diameter of the burning focus, and the weight of the whole lens exceeded two hundred pounds. A subscription was attempted for the purpose of defraying the expence of this fine instrument, but it failed; and the instrument itself was purchased by Captain Macintosh, who accompanied Lord Macartney in his embassy to China; and is now probably deposited among many ingenious and valuable presents, the use of which is unknown to the Chinese.

BURNS, Robert, the far-famed Scottish poet, was a native of Ayrshire, and was born on January 25th, 1759, in a cottage near the church of Alloway, and those scenes which are so finely commemorated by his muse. His father, from the north of Scotland, had been nursed in the school of misfortune; had acquired much knowledge of men and manners; but, possessed of stubborn, ungainly integrity, and headlong ungovernable irascibility, disqualifying circumstances to insure success in the world, as the poet himself strongly expresses it, he was doomed through life to be a poor man. When he settled in Ayrshire, he was engaged as gardener and overseer to a gentleman near the spot where Robert was born; his affairs were unprosperous; he changed his residence twice to different farms; but adversity and poverty still pursued him, till death at last relieved him from his sorrows, and his all was seized by his creditors.

The education of the poet was extremely scanty. He received his elementary instruction in English at a private country school taught by Mr Murdoch, who has drawn up an excellent account of the early part of his life; and to the same teacher he was indebted for a smattering of French. He derived his knowledge of arithmetic from his father; and acquired the practice of writing at the parish school of Dalrymple. The books recommended by his father, or which he perused at a future period of his life before he was known as a poet, were Salmon's and Guthrie's Geographical Grammars, the Spectator, Pope's Works, some Plays of Shakespeare, Locke's Essay on the Human Understanding, Stackhouse's History of the Bible, Hervey's Meditations, Allan Ramsay's Works, and a Collection of English Songs. He had dwelt with enthusiasm on the life of Hannibal, and the History of Sir William Wallace, the Scottish patriot; and he had drawn a great deal of legendary lore in his early years from an old woman, a resident in the family, and remarkable for her ignorance, credulity, and superstition. Such was the extent of education and reading which fell to the lot of Burns.

His first attempt at rhyme, as the poet himself relates his story, was in his 16th year, in the composition of some verses in praise of Mary Campbell, a Highland girl, who had been his fellow-reaper in the field during harvest, and who was the object of his first attachment. When the autumnal labours were over, they parted never to meet again; but the intelligence of her death restored to his heart the softened image of his early passion, and awakened his muse to one of her tenderest effusions, in the *Address to Mary in Heaven.* About the 23d year of his age he spent some time in Irvine, to qualify himself for the business of flax-dressing; but an accidental fire destroyed his little property, made him abandon this undertaking, and brought him back to his family and the labours of the field. After the death of his father, which happened soon after, the family, with a laudable attachment to their mutual interests, united their means and exertions in the cultivation of a farm in a different part of the county. But an ungenial soil, and a succession of bad crops, rendered their labours unproductive, and again involved them in pecuniary embarrassments. At this time Burns became known in the neighbourhood as a poet; some of his satirical and humorous productions, circulated in manuscript, were much read, and greatly admired; his convivial habits had acquired some influence over his conduct; his attachment to his future wife had commenced, and he had become a father before he was a husband. Soured by disappointment, and pressed by penury, the poet had resolved to seek better fortune in a distant land; but the scantiness of his resources left him no alternative in procuring a passage to Jamaica, to which his views were directed, but to come under indentures to serve for a fixed period as a planter. The publication of the first edition of his poems by subscription at Kilmarnock, relieved him in some measure from his difficulties; yet still he contemplated his voyage across the Atlantic; he had bidden adieu to his native land; and his clothes were packed up, and on the road to Greenock, from which he was to embark, when his poems had attracted the notice of Dr Blacklock; and a letter from that amiable poet and excellent man induced Burns to visit the metropolis of Scotland.

A new scene opened before the bard when he arrived in Edinburgh, in the winter of 1786 and 1787. Some account of the Ayrshire Ploughman, and some extracts from his poems, had appeared in the Lounger, then publishing periodically; his society was courted by all ranks; and a new edition of his poems brought him about L.700 Sterling. With this favourable turn in his affairs, it must ever be regretted that the poet had not the prudence or resolution to return immediately to his former habits of industry; and yet it is scarcely to be wondered at, that a mind less ardent than that of Burns was unable to oppose the current of dissipation along which he was carried. He spent part of the succeeding summer and autumn in tours through different parts of the country, but seemingly without any determinate object in view; and he returned to Edinburgh in the following winter, in the hope, it is supposed, of procuring some permanent appointment; but the great friends which his genius had secured him, and the powerful patrons who pretended to take an interest in his welfare and reputation, either thought him unworthy, or were unwilling to procure for him a better place than the humble office of an excise-officer, than which no situation could be worse calculated to the habits and character of Burns. At the same time he rented a farm in Dumfries-shire on favourable terms, and soon after fixed his residence with his family upon it; but it soon appeared that his attention was too much distracted in the pursuit of two very different objects, to encourage the hope of flattering success in rural affairs; and in his excise concerns he was led into that kind of society from which it would have required more fortitude than the poet now possessed to depart without excessive indulgence. His farm was neglected, disappointment and derangement of his affairs followed, and, having resigned his lease, he retired to the town of Dumfries, with no other income than the salary of an excise officer for the support of his young family.

The residence of the poet in Dumfries was by no means favourable to his habits. His society was courted by the idle, the gay, and the dissipated, who were delighted with his conversation, or amused with the sportive sallies of his humour, or the happy effusions of his wit; and perhaps many who had neither capacity nor taste to admire the powers of his genius, were eager to solicit his acquaintance and society, that they might be able to boast of an intimacy with so extraordinary a man. The closing scene of the life of Burns now approaches. While he was embarrassed in his worldly affairs, and his mind was clouded with gloomy reflections, partly arising from his own imprudence, and partly induced by the destitute and helpless situation in which he foresaw his family would be placed, his body was fast wasting with disease. In the end of June 1796, he retired to the shores of the Solway Frith, for the purpose of trying the effects of sea-bathing. On the 18th of July he returned to Dumfries, in a state of great weakness; a fever was upon him, which continued to increase, and on the fourth day relieved him from the disappointments, the cares, and the sufferings of this world, at the early age of thirty-seven.

Every mark of respect was paid to the memory of the bard at his funeral. Being a member of a volunteer corps, he was buried with military honours, and the solemn procession was attended, not only by the volunteers, but by the regular infantry and cavalry then stationed in Dumfries, as well as by the principal inhabitants of the town and neighbourhood. But it was not the least affecting incident to the family of the departed poet, that, at the very time that his mortal remains were committed to the earth, his afflicted widow brought forth a son. This infant soon followed his father to the same grave. Four sons survived him, and for them and his widow, who were left in great indigence, a subscription was entered into, and a liberal sum raised.

It is melancholy to reflect on the last scene of the poet's sufferings; and nothing can be a stronger proof of the anguish of his mind, than the dread under which he laboured of being thrown into prison for a debt of no great amount; even in the rage of the delirium which prevailed during the last days of his existence, the horrors of a jail haunted his imagination; yet what hand was stretched out to relieve his distress? Who, of all his numerous friends and patrons, contributed to raise the depressed spirits of the afflicted bard? What, indeed, must have been his difficulties, when the lofty mind of Burns, who, whatever were his faults and failings, never betrayed a mean or mercenary spirit, was compelled to solicit L.5, that he might be enabled to ward off the danger which alarmed his fears. But the world, seemingly conscious of the neglect which he experienced while living, is determined to make ample amends by every expression of regard to his posthumous fame. A magnificent mausoleum has been erected over his ashes at Dumfries, the expence of which was defrayed by subscriptions, not only in Britain, but in distant quarters of the globe. Similar monuments are proposed to be raised to his memory, and the anniversary of his birth is celebrated in all parts of the kingdom.

Numerous editions of the works of Burns have appeared since his death, one of which, in four volumes octavo, has an elaborate life of the poet prefixed, by the late Dr Currie of Liverpool, and was published under his superintendence for the benefit of his widow and family. The profits of this edition, it is understood, afforded a very handsome sum. Beside the poems which appear under his own name, Burns contributed many songs to the Museum, published by Mr Johnson, engraver in Edinburgh, as well as to the more elegant and perfect work of Mr Thomson of the same place.

BURNTISLAND, a royal borough of Fifeshire in Scotland. See Bruntisland.

BURSA, or Burse, originally denoting a purse, is used, among middle age writers, to signify a little college or hall in a university, for the residence of students; and in more modern times is applied to a foundation for the support of poor scholars in their studies, who are hence called Bursars.

BURTON, Robert, a learned English author, was a native of Liecestershire, and was born in 1576, was educated at Oxford, and having entered the church, was fortunate in being presented with several livings. But his name has been transmitted to posterity as the author of a singular production, entitled the *Anatomy of Melancholy*, a work which had a great circulation; and from which it appears, from the enquiries of Dr Ferriar, published in the Manchester memoirs, that the celebrated Sterne borrowed some of the most striking passages of his works. Mr Burton, it is said, was strongly attached to astrology; and having predicted the period of his own death, committed suicide rather than allow his calculation to fail.

BURTON UPON TRENT, a borough town of Staffordshire, stands on the west bank of the river Trent, is a place of considerable antiquity, contains about 4000 inhabitants, who are occupied in the manufacture of cotton and woollen stuffs, iron mongery, and hats. Burton is well known for its excellent ale, which finds a market not only throughout the kingdom, but is exported to different parts of the continent. The Trent, which is navigable for boats, and the canals which communicate with the principal parts of England, afford great facilities to the trade of this place.

BURY, a borough town of Lancashire, in England, stands on the east bank of the Irwell, and has risen of late years to considerable importance, by the introduction of different manufactures. The population exceeds 7000; coarse woollen goods, and all kinds of cotton stuffs, are manufactured; bleaching and calicoe printing establishments, on the banks of the river, are extensive and prosperous. Bury is 9 miles from Manchester, and 194 miles from London.

BURY, ST EDMUNDS, a borough town of the county of Suffolk in England, is situated on the river Sark, and is highly celebrated for its pure air and genial climate; is a place of considerable antiquity; and the remains of a monastery, which is said to have been one of the richest in the kingdom, still exhibit an elegant specimen of its former splendour. The churches and some of the other public buildings are fine edifices; the population is about 7000, and the only manufactures are woollen stuffs of a fine fabric.

BUSCHING, the celebrated author of a System of Geography, was a native of Germany, was born in 1724, and received the early part of his education and his instruction in the learned languages from the minister of a German congregation at Copenhagen, and afterwards studied divinity at Halle. Being appointed to superintend the education of a young nobleman, he accompanied his pupil to St Petersburgh in 1749; and at this time, it is said, he projected the new system of Geography which he afterwards executed. He was afterwards nominated a professor of philosophy at Gottingen; and in 1761 he was invited to St Petersburgh, to accept of the office of pastor to a Lutheran congregation; and during his residence in that metropolis he founded a public school, which obtained considerable celebrity; but some differences having arisen he returned to Germany, remained some time at Altona, and in 1766 he was appointed director of a Gymnasium at Berlin, where he died in 1793.

Busching was distinguished as an author by his learning and indefatigable industry; his geographical work alone, which was published at different periods from the year 1754, and was completed in six 4to volumes, affords ample evidence of his ability and perseverance.

BUSHEL, a dry measure of capacity, and particularly employed for grain, contains four pecks or eight gallons, or one-eighth of a quarter. By the enactment of Henry VII. a bushel must contain eight gallons of wheat; the gallon eight pounds of wheat, troy weight; the pound twelve ounces, troy weight; the ounce twenty shillings, and the shilling thirty-two grains, or corns of wheat, growing in the midst of the ear. When this standard bushel was measured before the house of Commons in 1696, it was found to contain 2145.6 solid inches of water, and the weight of the water amounted to 1131 ounces and 14 pennyweights troy. The bushel varies greatly in different parts of England. At Abingdon and Andover it contains 9 gallons; at Appleby and Penrith, for pease, rye, and wheat, 16 gallons, and for oats, barley, and malt 20 gallons; at Carlisle, 24 gallons; at Chester for wheat and rye 32 gallons, and for oats 40 gallons; at Dorchester for malt and oats 10 gallons; at Falmouth for coals 16 gallons, and for other commodities 20 and 21 gallons; at Kingston upon Thames $8\frac{1}{2}$ gallons; at Newbury 9 gallons; at Wycombe and Reading $8\frac{1}{4}$ gallons; and at Stamford 16 gallons.

BUSHIRE, a sea-port town of Persia, at the extremity of a peninsula in the Persian gulph. The town is of a triangular form, washed on two sides by the sea, and fortified on the land side by a wall and bastions; the streets are narrow, and the houses, which are chiefly of mud, are mean and low, but the harbour is commodious, and a considerable trade is carried on with India, and with the interior of Persia, by means of caravans. The population is stated at 10,000.

BUTCHER is a person who slaughters cattle for the use of the table, or who cuts up the flesh and retails it. Three descriptions of persons were employed in this business among the ancient Romans; one provided hogs for the market, another furnished cattle and other animals, and under them was a subordinate class, whose office was to kill the animals. Two classes of butchers are recognised in London; *carcase butchers*, who slaughter animals in great numbers, and dispose of meat to the *retail butchers*, who are dispersed in different places for the supply of their customers. The company of butchers in London was incorporated in the third year of the reign of James I. Numerous legislative enactments have been made for regulating the trade of butchers, with the view of bringing sound meat into the market, of preventing nuisances in killing cattle, and the injuring of hides by cutting, or allowing them to become putrid, to the prejudice of the tanner.

BUTE, an island in the frith of Clyde, on the west coast of Scotland, is about 15 miles long, and three miles broad, including about 24,000 Scotch acres. The coast is rocky, and indented with several bays, and the highest land is not more than 400 feet above the level of the sea. The northern district of the island is chiefly composed of primitive rocks, as micaceous and argillaceous schistus; and of the latter, the common roof slate, quarries have been opened, and extensively wrought. Red sand stone is also a prevailing rock in many parts of the island, and rocks of trap or basalt are also common. Speculative geologists have encouraged the hope of discovering coal, and attempts have been made to search for that valuable mineral, but they were unsuccessful; and it may be added, that any future trial for the discovery of coal in such rocks, with which it is never associated, will have a similar termination.

The soil of Bute is generally of a light and sandy nature, but answers well for every kind of husbandry. The island itself furnishes abundance of manure from sea-weed, extensive beds of sea shells, and limestone, in different places. Much of the land is well enclosed and subdivided, and the chief productions are barley, oats, and potatoes, for which Greenock and Glasgow offer a ready market, as well as for their cattle. The surrounding sea abounds with excellent fish, and numerous wild fowl frequent the coast and the inland parts of the country.

The marquis of Bute is the principal proprietor of the island, and he has an elegant mansion embosomed in thriving plantations on the eastern shore. The population, which in 1801 amounted to 6,106, has since that time increased. The inhabitants are chiefly employed in agriculture, fishing, and cotton spinning. Rothsay is the capital of the island and of the county which includes Arran, the two Cumbraes, and Inchmarnoch. The population of the county, estimated in 1801 at 11,791, had increased in 1811 to 12000.

BUTLER, Samuel, author of Hudibras, a well-known burlesque and satiric poem, was born at Strensham in Worcestershire in 1612. The particulars of his early life are little known, and have been variously represented. He is imagined to have studied for some time at Cambridge or Oxford; but such a supposition, in the absence of satisfactory evidence, is quite unnecessary to account for the range of learning displayed in his singular production. As clerk to Mr Jeffreys, an eminent justice of the peace in his native county, he had opportunities, not only of study, but for recreation, especially in music and painting; and being subsequently an inmate in the family of the countess of Kent, he enjoyed the advantages of a good library, and an acquaintance with the illustrious Selden, one of the most erudite men of his time. Why he relinquished this situation cannot be ascertained. He afterwards resided with Sir Samuel Luke, one of the chiefs of the Puritan party, whose principles and practices he has represented in so ludicrous and sarcastic a manner. On the restoration of the royal family, he was made secretary to the earl of Carbury, then president of Wales, who gave him the stewardship of Ludlow castle. But these rewards were not equal to his expectations, nor perhaps suitable to his abilities. The publication of part of his poem procured him praise enough at court, and Lord Clarendon excited his hopes of obtaining something worthy of royal gratitude. But the promises of that nobleman were never fulfilled; and the neglect of a man who had contributed so much, as Butler appears to have done, to the merriment and triumph of the prospering cause, is one of the many instances of selfishness and ungenerous caprice in the conduct of the Second Charles. How much some of his contemporaries blamed such ingratitude, is manifest from an anecdote related by Packe, in his Life of Wycherly, which, besides, presents a striking likeness of the times, and of one of its principal characters. "Mr Wycherly had always laid hold of any opportunity which offered of representing to the duke of Buckingham (Villiers) how well Mr Butler had deserved of the royal family, by writing his inimitable Hudibras; and that it was a reproach to the court, that a person of his loyalty and wit should suffer in his obscurity and under the wants he did. The duke always seemed to hearken with attention enough; and after some time undertook to recommend his pretensions to his majesty. Mr Wycherly, in hopes to keep him steady to his word, obtained of his grace to name a day, when he might introduce that modest and unfortunate poet to his new patron. At last an appointment was made, and the place of meeting was agreed to be the Roebuck. Mr Butler and his friend attended accordingly; the duke joined them; but, as the d—l would have it, the door of the room where they sat was open, and his grace, who had seated himself near it, observing a pimp of his acquaintance (the creature, too, was a knight) trip by with a brace of ladies, immediately quitted his engagement, to follow another kind of business, at which he was more ready than in doing good offices to men of desert, though no one was better qualified than he, both in regard to his fortune and understanding, to protect them: and from that time to the day of his death, poor Butler never found the least effect of his promise." He died in 1680, and was buried in Covent-garden church-yard, at the cost of his benefactor Mr Longueville, who, in vain, solicited a subscription for his interment in Westminster-abbey. About sixty years after his death, the munificence of Mr Barber, a printer, mayor of London, raised a monument for him in this latter place, bearing an inscription, which pointedly alludes to the poverty of his life.

The first part of Hudibras was published in 1663; the second in the following year; and a third, which still leaves it imperfect, in 1678. He was author of several other works, some of which were published long after his death. But they are of inferior merit, and are comparatively little known. A work like Hudibras is enough for a single reputation. It is quite an original, full of peculiar and extraordinary qualities, in vain sought for in the numerous productions which have imitated its manner, and is perhaps more extensively read and relished than any piece of poetry of equal length in our language. This distinction it is impossible to explain, consistently with the objections which have been stated against its method, its style, its story, and its principles, without admitting it to possess some great and interesting excellencies. Its fame has not been confined to our own country, although it utterly baffles the endeavours of the translator, and its merits can only be properly appreciated by a native. "It is one of those compositions," says Dr Johnson, "of which a nation may justly boast;"—and the name of Butler "can only perish with his language."

BUTLER, Joseph, a learned English prelate, was born at Wantage in Berkshire in 1692. His father, a respectable shopkeeper, and a member of the presbyterian denomination, perceiving the studious disposition of this the youngest of eight children, sent him, after some preparatory education, to an academy, superintended by Mr Jones, in which he applied himself with uncommon ardour to several branches of literature. It was in this seminary, amid a multiplicity of pursuits, that he gave the first fruits of that profound and speculative intellect which was destined to obtain such commanding influence in a peculiar department of learning. In seriously perusing Dr Clarke's famous Demonstration of the Being and Attributes of God, which then attracted general notice, he thought he perceived some obscurity and imperfection in the mode of reasoning adopted by that celebrated author. His doubts were successively transmitted by letters to the doctor, who had the penetration to discover the sagacity of his unknown correspondent, and the politeness to reply to him. The friendship of that great man was a natural consequence of the acquaintance which afterwards took place between them, and contributed to a material change in the views and sentiments of young Butler, who henceforth, in opposition to the remonstrances of his father and the wishes of his most intimate associates, resolved to attach himself to the church of England. In prosecution of his new plan he removed to Oriel college, Oxford, where he was admitted a commoner in 1714, and where he was afterwards ordained for the ministry in the establishment.

Through the recommendation of Dr Clarke and other friends, he was appointed, at the age of 26, to the honourable office of preacher at the Rolls chapel. Here he delivered fifteen sermons, which were afterwards published, and which confirmed his reputation as one of the most original and powerful reasoners on the important subjects of natural religion and moral science. These singular productions will ever be esteemed by philosophical inquirers, but are utterly destitute of those graces and embellishments which allure the fancy and warm the feelings of superficial readers. His friends did not neglect his preferment, while he himself was wholly occupied in abstruse speculation. He was presented to the benefice of Haughton, and then to the rectory of Stanhope, in which he devoted seven years to the discharge of parochial duties. But this seclusion proving injurious to his too melancholic disposition, Mr Secker, who had all along urged his advancement, again succeeded in his favour, and obtained for him the appointment of chaplain to Lord Chancellor Talbot, which required that a considerable portion of his time should be passed in town. He was in two or three years time made clerk of the closet to queen Caroline, who appears to have been fully sensible of his great merits. It was shortly after being chosen to this creditable office that he published the work by which he is best known, and which, by its substantial excellencies and importance, must perpetuate his name while sound reasoning and good sense are esseemed among mankind. The treatise now alluded to, and which no scholar need be informed is, "The Analogy of

Religion, Natural and Revealed, to the Constitution and Course of Nature," and is one of those few but enviable productions, which it is impossible for any candid man, whatever may be his opinions, to have carefully read once without admiration, and which it is no less impossible to re-peruse, however frequently, without finding his admiration justified and heightened. Soon after the death of the queen, who recommended him to the notice of her consort, our author was promoted to the bishopric of Bristol, to which, at no great distance of time, was added the deanery of St Paul's, London. While in this latter office, he was sometimes called to preach on public occasions. The sermons then delivered were printed, and are generally found in the same volume with those which he formerly preached at the Rolls. In 1746 he was made clerk of the closet to the king, and in 1750, was translated to the see of Durham,—a preferment well suited to the generosity and beneficence of his character, but which his increasing infirmities did not suffer him long to enjoy. His primary, and indeed only charge to the clergy of that diocese, the object of which was to enforce attention to the forms and ceremonies of religion, exposed him to no small censure, as leaning to the superstitions of popery. But it appears no way difficult to reconcile the whole of his sentiments in that discourse with the principles and the practices of the communion to which he belonged; nor is there the slightest foundation for an assertion which was made 15 years after his decease, that he died in the faith of Rome. Archbishop Secker, bishop Halifax, and others, have amply vindicated his memory from this aspersion. He ended his days at Bath, where he had gone for the recovery of his health, on the 16th June 1752, aged 60, and was interred in the cathedral at Bristol. Dr Butler was never married. He is not known to have published any other works than what have been enumerated, and two Dissertations on Personal Identity and the Nature of Virtue; but a treatise on Faith has been ascribed to him, perhaps on doubtful evidence.

BUTOMUS, Flowering Rush, or Water Gladiole, a genus of plants belonging to the Enneandria class. Butomus Umbellatus is a native of England.

BUTTER, an unctuous substance, of a yellow colour, and an agreeable sweetish taste, which is prepared from milk, by the well known process of churning. In many of its properties it resembles oily bodies. The Greeks, it is supposed, derived their knowledge of the process of making butter from the Scythians; and, according to some historians, the Romans were indebted to the Germans for the preparation and use of this substance. The word is frequently used in the translation of the Scriptures of the Old Testament; but doubts are entertained whether the original word, which is thus translated, ought to be taken in that sense. See Agriculture.

BUTTON, an appendage of dress, which is sometimes employed as an ornament, and sometimes for useful purposes, in fastening and securing different garments. The fabrication of buttons is a very extensive manufacture in some parts of England; and the cheapness of the produce of this manufacture is a proof of the facility with which is is carried on.

BUTTON-MAKING.

Buttons are made of various materials, as horn, bone, wood, and leather, which are either covered with thread, hair, silk, or some other fibrous substance, or are used plain; more commonly they are made of different kinds of metal, which are either polished, plated, or gilt; and another kind of button is made with a mould of bone or wood, covered with cloth of the same kind as the garment to which it is attached.

Moulds.—Button moulds are usually made of bone, and this operation is performed with great dexterity by means of the lathe, and with appropriate instruments. The larger moulds are first cut out, and afterwards smaller ones are cut out from the remaining spaces, and the minute and the small fragments, saw dust, or shavings, are disposed of for case-hardening iron toys and different kinds of cutlery, and what is unfit for this purpose is sold to the farmer for manure; so that no part of the materials in this manufacture is lost. Button moulds are made with astonishing rapidity; young persons of ten or twelve years of age acquire such facility in the operation, as to be able to cut out 30 moulds in a minute. Moulds of a larger size are made of wood, of a hard and tough quality, as oak, elder, or beech.

Covering of buttons.—Button moulds, according to the fashion of the present day, are generally covered with a piece of the cloth of the garment to which they are attached; but in former times they were covered with pieces of cloth made of silk, mohair, gold twist, and other expensive materials. These substances, formed into thread, were wrought or twisted on the mould according to different patterns, and were sometimes still farther ornamented with silver or gold sewed on the surface.

Cleansing hair or silk buttons.—To remove the superfluous projecting hairs or filaments of the material with which the button is covered, a number of buttons is introduced into a kind of iron sieve, which is called by the workmen the *singeing box.* A little spirit of wine is then poured into a shallow iron vessel and set fire to, when the workmen move the singeing box with the buttons briskly over the flame of the spirit, so that all the loose projecting filaments are burnt off, and, when the operation is properly performed, without any injury to the buttons. They are then put into a leather bag, of a conical form, and about three feet in length; and crumbs of bread being introduced into the bag at the same time, it is briskly shaken with a particular kind of motion, by which the buttons are cleaned, and rendered beautiful and glossy, and fit for the market.

Button shanks.—The shank, or eye of the button, as it is sometimes called, is made of iron or brass-wire, and in its progress passes through several operations. The wire is first coiled round a flat steel bar, with the two opposite sides rounded. When the coil of wire is completed, it is slipped off the bar, and a wire fork being introduced, it is laid upon an anvil, and struck with a punch, the edge of which presses the wire between the branches of the fork, and the wire being cut with shears at the place marked by the punch, each coil is divided into two button shanks. The wire is usually rolled on the steel-bar by screwing one extremity into the spindle of a lathe, and the different operations are performed with great rapidity.

But an ingenious improvement in this simple operation, has been introduced at Birmingham. A machine is so contrived, that merely by turning a winch it supplies itself with the wire from a reel, and, after performing the different operations of cutting and bending to the proper form, delivers the shank completely finished. One shank is formed at each turn of the winch, and the power required to set the machine in motion is so small, that the strength of a boy is sufficient for the purpose. But the inventor has carried his improvement still farther; he employs a steam-engine as the moving power; in this way a number of machines is wrought in the same apartment, and, by this wonderful abridgment of labour, can produce these articles at a price which little exceeds the original cost of the wire.

Horn buttons.—Horn buttons are either made with shanks fixed to them, or they are fastened with thread by means of holes drilled for the purpose. When the button is secured in the latter way, it is generally made concave on the surface, that the threads by which they are secured to the garment may be preserved from wearing.

The hoofs of cattle furnish the material for the fabrication of horn buttons; and in the process by which they are made, advantage is taken of the property of horn becoming soft by means of heat. The hoofs are first boiled in water till they are soft; they are then cut into parallel slips of the breadth of the intended diameter of the button by means of a knife, which acts in the form of a lever on the bench or table where the operation is performed; and the slips are again cut into squares, the angles of which being cut off, each piece is brought nearly to the size of the button. The pieces are then put into a bath composed of logwood, galls, and copperas, for the purpose of communicating a black colour, after which they are dried for a week. The dies which give the impression to the button are fixed to the number of eight or twelve, according to circumstances, in an iron plate, which is united, by means of a joint or hinge, to a corresponding plate, between which the button is strongly pressed. These moulds, of which a great number is provided, are put into a kind of oven or furnace, till they acquire a temperature somewhat higher than that of boiling water; a piece of horn is then placed upon each impression in the mould; which is closed, and kept in a small screw press for a few minutes till the horn is softened. The mould is then subjected to very strong pressure, during which the pattern is communicated from the die to the horn; and in this state it is kept till it is cool, which requires about 20 minutes, otherwise the horn would be apt to return to its original form.

The holes in buttons without shanks, or what are called sailors buttons, are made by means of spindles, to which drilling instruments are attached; to these drills the button, held fast, is presented in the lathe, and the perforations are instantly completed. These spindles are so contrived, that they can be placed at different distances to answer larger or smaller buttons. But when a shank is attached to horn buttons a small hole is drilled in the horn to receive it, and a cavity being left in the mould to admit the shank, the softened horn is so firmly closed around it by the pressure, that when it cools and becomes hard it is completely secured. Sometimes ornamental figures are formed on the surface of plain horn buttons by means of a thin brass plate, out of which a pattern is cut. The plate is applied to the surface of the button, and the uncovered parts of the surface being rubbed with emery powder present a rough appearance, while those parts which are protected by the brass retain a fine black polish.

Dressing the edges.—The edges of horn buttons which project beyond the cavity of the die in the pressure, are cut off by means of shears, and filed smooth and round in a lathe, which is so constructed that two spindles, furnished with chucks, having a cavity in each for admitting the button, are brought close together and hold the button firm between them, while they are turned with the same degree of velocity, and the operation of filing and polishing the edge is performed.

Metal buttons.—Metallic substances are more generally employed in the fabrication of buttons, some of which are made by casting them in moulds, and others are formed of single pieces cut out of plates. Those of the first description are made of brass, pewter, or some other cheap alloy. Patterns are then prepared of the form of the button required, and they are connected together by small bars, so that the whole are in the same plane. The patterns thus connected vary in number from four to twelve dozen. An impression of these patterns is then taken in sand, a shank is introduced into the centre of each impression, and the whole are filled with the fused metal, which is usually a mixture of brass and tin, to which sometimes a small portion of zinc is added, for the purpose of making the metal flow freely, and producing a sharp impression. The metal being cooled, the buttons are taken from the moulds, cleaned from the sand by brushing, and carried to the lathe, where the edges are rounded and smoothed by filing. A third person is employed in smoothing the back of the button and turning the projecting part of the shank. This operation is also performed in the lathe, as well as that of smoothing the face of the button, which is executed by a fourth person.

The next operation is that of polishing, which is generally performed by women. The shank of the button being secured, the face is rubbed on a board, covered with leather, and spread with powder of rotten stone; in a second polishing a finer powder is employed; and the last polish is given by holding the button lightly to a circular board, which

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is covered with soft leather spread over with the finest powder of the same materials as are used in the first polishings. This board is moved by the lathe.

The last operation in the manufacture of buttons of this description is boiling or washing, for the purpose of communicating a purer white to the polished surface. This process is performed by boiling a quantity of granulated tin in a solution of cream of tartar; a portion of the tin is thus dissolved, and the buttons, arranged on a grating of wire, being immersed in the solution, their surface is covered with a thin layer or wash of the metal, which improves their whiteness, while the polish remains uninjured.

Plated buttons.—In the fabrication of plated buttons, copperplates, covered on one side with silver, are previously prepared, and reduced to the proper thickness in a flatting mill. Circular pieces are the ncut out of the plate, by stamping, by means of a fly-press. In this operation the copper side of the plate is placed upwards, and the hole through which they are stamped is somewhat chamfered at the edge, for the purpose of turning the silver plate over the edge of the button. These circular pieces, which are technically called *blanks*, are introduced into a furnace to undergo the process of annealing, by which they are softened and rendered fit for bearing the operation of stamping, which is performed by means of a machine which operates in the manner of the pile-engine. The striking part of this machine, which is from one to two hundred weight, is grooved on the edges, and the grooves exactly fit the projecting parts of two strong pillars, which are placed perpendicularly, that the surface of the plate or button, which is placed horizontally, may be fairly struck. The stamp or die, which gives the form or impression to the blank or button, is fixed in the centre of the moveable or striking part of the machine, and the plate or button is placed on the fixed or lower part. The striking part is raised by means of a pulley and strong rope, which the workman moves partly with his hands and partly with one foot, which is placed in a stirrup attached to the end of the rope. In this way he raises the weight with a sudden dexterous jerk; and when it is sufficiently elevated, he lets it go as suddenly, when it falls on the plate or button, and communicates the form or impression of the stamp or die which is employed. When any impression is to be given to a plated button, after the shank has been attached to it, the shank is introduced into a cavity, formed by two pieces of steel, which, when united together, are of a conical form, and the top is convex, to correspond with the concave back of the button which is placed upon it to receive the impression.

The blanks for plated buttons being cut out and stamped, have the shanks soldered on; and this operation is performed on each button individually by means of the flame of a lamp, the heat of which is increased by the blow-pipe urged by bellows. Silver solder is employed for this purpose. For plain plated buttons, the next operation, after the shanks are soldered on, is to smooth the edges, which is done with a file in the lathe, observing the precaution of not continuing the application of the file so long as to remove the silver, which is turned over the edge. To clean the backs, the buttons are dipped in acid; and to whiten them they are boiled in cream-of-tartar and silver. The backs of the buttons are then brushed clean while they revolve in the lathe; after which they are subjected to the operation of burnishing. This is also performed in the lathe, which is then moved with great velocity. The burnishing substance, which is called by the workmen a blood-stone, and is an ore of iron, is fixed in the handle; and being dipped in water, is applied to the surface of the button, to which it instantaneously communicates a fine polish. But to render the polish still more perfect, a stone of the same kind of a finer quality is employed, and this finishes the operation.

When an impression is to be given to the surface of a button, a die, on which the intended impression is cut, is fixed in the upper or moveable part of the machine in the manner already described. But, before the blank is fixed in the machine to receive the impression, a circular piece of paper of the same size is perforated by the shank, and brought in close contact with the back. This paper is found useful in making the impression of the die sharper, and giving a dead appearance to the back of the button, when a fine polish is not required. The projecting edges are removed exactly in the same way as in cutting out the blanks, and the fileing and smoothing of the edges are performed in the lathe, as already described.

Gilt buttons.—The blanks for gilt buttons are cut out from copper, exactly in the same way as for buttons of the former description. The circular pieces are then stamped to give them a slight convexity that the buttons may not adhere together in the process of gilding. The soldering of the shanks is executed in a different manner from that of the former kind of buttons. Each blank is furnished with a small spring, which holds the shank down upon it in the proper place. A small portion of spelter and borax, mixed with water, is placed round each shank, and ten or twelve dozen of buttons being thus prepared, are placed on a flat iron plate which is introduced into an oven, the temperature of which is sufficient to fuse the solder; when this is observed, they are withdrawn from the oven, and while they are yet warm, they are thrown into a liquor which is called pickle, and is composed of water with the addition of aquafortis, or weak nitric acid of the shops. By the action of theacid, the surface becomes black, and the edges of the buttons are then filed and smoothed in the lathe. They are dipped in a second pickle more diluted with water, by which the surface is cleaned, and after being burnished in the lathe, they are ready for the process of gilding.

Gilding.—That quantity of gold which is to be applied to a certain number of buttons, which is astonishingly small, five grains being fixed by the statute for gilding 12 dozen of buttons of one inch diameter, is put into an iron ladle with a small quantity of quicksilver, and exposed to heat till the metals are united. The proper number of buttons is then in-

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troduced into an earthen pan, and the amalgam of gold and mercury is put into the pan, with as much aquafortis diluted with water as is sufficient to moisten the whole; they are then stirred up with a brush till the amalgam come in contact with every part of the surface of the buttons, when they become white with the covering of the mercury and gold. This process is technically called *quicking*.

Drying off.—The next object of the manufacturer is to separate the mercury, that the gold may remain as a covering to the button. This process, which is called *drying off*, is accomplished by putting the buttons into a flat iron pan, which is constantly shaken over a fire to communicate an equal degree of heat, and the operation is continued till the mercury have the appearance of melting. The buttons are then introduced into a felt cap, and stirred about with a brush that the amalgam of gold and mercury may be equally spread over their surface, while the mercury is at that temperature which nearly renders it volatile. The buttons being returned to the pan, the increased heat drives off the mercury in the state of vapour, and the yellow colour of the gold begins to appear on the surface. The same processes are repeated a second time, and if afterwards any white spots should remain, the buttons are put into a cylindrical copper box with a lid, and thus being turned round on a charcoal fire to heat all the parts equally, the remaining mercury is separated, and the gilding process is now completed; all that remains is to burnish the buttons by the same operations as have been already described in finishing plated buttons. In some cases the buttons are double and treble gilt, and this is done by repeating the different processes.

In the common mode of drying off, the mercury which is employed in the gilding process is not only lost, but the workmen are exposed to its fumes, which are extremely noxious. To preserve the mercury, and at the same time to secure the operator from the vapour, an apparatus has been contrived by Mr Sanders, a button manufacturer at Birmingham. A kind of furnace or oven, the bottom of which is an iron plate, is constructed over a hearth or fire-place; the front part of it is covered with glass, that the workmen may see the operation, and the glass comes down so low as just to leave room for moving the pan in which the buttons are heated. From the top of this oven proceeds a tube, which terminates in a tub of water in which the mercury which flies off is condensed; and in case any of the mercury should remain uncondensed, another tube proceeds from the first tub, which is closely shut, to another placed on the outside of the building. In this way the whole of the mercury is collected, without any inconvenience to the workmen.—*Phil. Mag*. vol. ix.

Gilt Buttons are sometimes milled on the edge, which is executed by a machine similar to that which is used for milling the edge of coins; and some buttons of the same description are ornamented with concentric circles. This operation is executed with a milling tool, which is a small steel roller, on the circumference of which the pattern required is cut; the operation is performed in the lathe, and the milling instrument is held in a slide-rest, that circles of the same diameter may be formed on all the buttons.

Buxton.

BUXTON, a village of Derbyshire, in England, which has been long celebrated for its mineral waters, and, from the remains of an ancient bath, and various roads which lead to this spot, seems to have been known to the Romans. But its mineral springs seem to have been forgotten till after the middle of the 16th century, when they were brought into notice by a treatise which was published, recommending their use as a cure for different diseases. The surrounding country, which is remarkable for its nakedness and sterility, renders the approach to Buxton, and the first view of the town, extremely striking to the traveller, and particularly the magnificent range of buildings erected by the duke of Devonshire, in the form of a crescent, and at an expence of L.120,000. In these buildings are three hotels, and some private lodging-houses, and the front is adorned with a splendid colonnade.

The population of Buxton is about 800, and it is supposed that not fewer than 500 persons, including their attendants, visit it annually on account of the waters. The manufactures are limited to a few cotton stuffs; for the principal support of the place depends on the strangers during the bathing season, which continues from June to October. The company are amused with assemblies and plays.

Buxton has the advantage of both cold and hot springs; the water is impregnated with lime in different states of combination, common salt, and a portion of azotic gas. The temperature of the hot spring is about 82° of Fahrenheit. Commodious places are fitted up both for bathing and drinking the waters.

Byrom || Byron.

BYROM, JOHN, the author of some fugitive poetry, was a native of Manchester, and was born about the year 1691, but few records of his life have been preserved. He contributed to the Spectator two humorous letters on dreams, and a poetical production which begins,

"My time, O! ye muses, was happily spent,"

all of which are in the 8th volume of that work. But he is best known as the author of an elegant system of short-hand, the teaching of which was his chief support, till he came to the possession of an estate by the death of an elder brother. He died in 1763; and a collection of his poems, in two volumes octavo, was published at Manchester in 1773.

BYRON, the HON. JOHN, was the fourth son of Lord Byron, and was born in 1723. In early life he entered the British navy, and was a lieutenant on board the Wager, one of the ships which accompanied commodore Anson in his expedition against the Spanish settlements in South America in 1740; but being wrecked on the coast of Patagonia, became the subject of his celebrated narrative, which, in the detail of the dangers, sufferings, and adventures in which he was concerned for five years, is unrivalled for the deep interest which it excites in the mind of the reader. Mr Byron, after his return to Britain, rose through the different gradations of the service to the rank of admiral, but was remarkable through

Byssus. life for the ill success which almost invariably accompanied all his services. He died in 1786.

BYSSUS, a fibrous matter mentioned by the ancients, and said to have been produced in India, Egypt, and some parts of Greece, and employed in the fabrication of the finest kinds of cloth, particularly for the garments which were worn by the Jewish and Egyptian priests. The Greek word which is met with both in the Old and New Testament, is rendered by some interpreters *fine linen*, and by others *silk*. Among the conjectures concerning the nature of the ancient Byssus, it is supposed to have been a fine kind of flax, cotton, a mixture of flax and cotton, or the silky matter of the *pinna*, a genus of bivalve shell-fish, some species of which are found on the shores of the Mediterranean.

BYZANTIUM, an ancient city of Thrace, situated on the Bosphorus, was founded, according to some, about the time that Tullus Hostilius reigned in Rome; but according to others, in the time of the Argonauts, by Bysas, a king of the surrounding territory, and from whom the city derived its name. The history of this city is closely connected with Roman affairs. It became a province subject to Rome the year after Jerusalem was destroyed by Titus; and, after various fortunes, it came under the dominion of Constantine the Great, about the year 323. Enlarged and beautified by this emperor, and enjoying all the immunities and privileges of the metropolis, it became the place of his residence, and at last received the honour of his name, from which time it has been called Constantinople, or the city of Constantine. Byzantium.

C.

Caaba. C is the third letter, and the second consonant of the alphabet, formed, according to some, from the Greek letter, and, according to others, from the Hebrew, the form of which approaches more nearly to the modern letter. Before the vowels a, o, and u, it is sounded hard like k, and before e, i, and y, like s. In some ancient inscriptions the Greek letter s, has the same form as our c. In abbreviations C stands for Caius, Carolus, Cæsar, *condemno*, &c. and CC. for *consulibus*. As a numeral, C denotes one hundred, CC, two hundred, &c.

CAABA, in its proper signification, denotes a square stone building, but is particularly applied by the Mahometans to the temple at Mecca, to which the followers of the prophet assign a very high degree of antiquity, supposing that it was built by Adam after he was driven from paradise, according to a design of a celestial temple which the Almighty let down from heaven, and placed in Mecca. Being destroyed by the deluge, it was rebuilt on the same spot by Abraham and Ishmael his son. Long before the time of Mahomet, this temple was a place of Pagan worship, and was greatly celebrated for sanctity. It is said to have contained 360 different images, corresponding to the number of days of the Arabian year. When Mahomet declared himself a prophet, and became at the same time a temporal prince, he seized this temple, destroyed all the images, and appointed it to be the chief place of worship for all true believers. In a corner next the east door, a black stone is deposited, and is highly venerated among the Mahometans. According to the tradition, it was brought down from heaven by the angel Gabriel at the creation of the world, and was originally of a white colour, but had contracted its blackness from the guilt of the sins committed by mankind. It is now enclosed in silver, is called by some the right hand of God, and is most devoutly kissed by pilgrims who visit Mecca.

The Caaba has a double roof, which is supported within by three octagonal pillars of aloes wood, and between them are suspended silver lamps from a bar of iron. The outside is covered with rich black damask, which is adorned with a band of gold embroidery. This temple is surrounded by two inclosures, and it enjoys the privilege of an asylum for criminals. Cabal || Cabot.

CABAL, the celebrated name of the ministers of Charles II., the first letters of whose names, Clifford, Ashley, Buckingham, Arlington, and Lauderdale, compose the word, which has been applied to associations formed for the purpose of contriving or executing illegal measures.

CABBALA, a word used by the Jews to denote those traditions relative to the interpretation of the law which they say were at first communicated by revelation, and have been transmitted unchanged from generation to generation. These traditions have been termed the oral law, in opposition to the written law. Another cabbala is called artificial, and consists in searching for abstruse and mysterious meanings of a word in scripture, from which certain explanations are borrowed, by certain combinations of the letters of which it is composed. This cabbala is divided into three kinds; in the first, the letters of a Hebrew word are taken for ciphers or arithmetical numbers, and every word is explained by the arithmetic value of the letters which enter into its composition; in the second kind, every particular letter of a word is taken for an entire diction; and in the third, different transpositions or changes of the letters are adopted. Those who profess the study of the cabbala are distinguished by the name of cabbalists, and they suppose that there is not a word, letter, or accent in the words of their law which contains not some mystery.

CABIRI, in ancient mythology, were certain divinities worshipped in some parts of Greece; and Cabiria were the festivals which were celebrated in their honour, with great solemnity, in Thebes, Lemnos, and Samo-Thracia.

CABLE, a thick strong rope which is employed for securing a ship at anchor. See Rope-making.

CABOT, Sebastian, a celebrated navigator, is supposed to have been born at Bristol, about the year 1477, where his father, a Venetian, had settled as a merchant and pilot, under the patronage of Henry VII. The father had received a commission from the king of England to undertake a voyage of discovery; he was accompanied by his son in his 20th year; and in this voyage Newfoundland was discovered. In the reign of Henry VIII. Sebastian Cabot sailed from England for the purpose of discovering a passage to the East Indies, which was then the favourite object of pursuit; but being disappointed in this attempt, he sailed to the southward, touched the coast of Brazil, and having traded for some time at Hispaniola and Porto-Rico, he returned to England. Having removed to Spain, he was appointed to an official situation, and constituted inspector of projects of discovery. Engaged by a company of Spanish merchants to undertake an expedition to the Moluccas or Spice islands by the straits of Magellan, he sailed from Cadiz in 1525, with four ships, and having reached the coast of South America, he was disappointed of the distant objects of the voyage by a mutiny of his crew and the want of provisions. He then sailed up the river La Plata, made various discoveries, and built a fort to overawe the natives. In the hope of being able to keep possession of the country, he dispatched a ship to Spain, and demanded a supply of provisions, ammunition, and troops, from his employers; but they did not support his plans; and having returned to Spain after six years absence, he met with no very cordial reception.

Returning to England about the end of the reign of Henry VIII. he was appointed grand pilot, with a handsome salary, was in great favour with Edward VI. and an expedition was fitted out under his auspices, for the purpose of exploring the north-east coast of Europe. This venerable navigator died in 1557, at the age of 80. Cabot is said to have been the first who discovered the variation of the compass, and he was eminently distinguished by his noble enthusiasm, bold enterprise, and professional skill.

CABUL, or KABOUL, a large province of Afghanistan, which lies between the 33° and 35° of north latitude, is about 250 miles long, and 150 miles broad, is greatly diversified by snowy mountains, hills of moderate elevation, and extensive plains and forests. Some parts of the province are traversed by considerable rivers, of which Cabul, called also in some parts of its course Attocka, and Cow or Cowmull are the chief. The principal towns are Cabul and Peshawer; the central districts near the capital receive sugar and cotton cloths from Peshawer, which they exchange for iron, leather, and tobacco; and the same commodities, with lamp-oil, are exported to Candahar, for which the returns are made in the manufactures of Persia and Europe. Horses, furs, and hides, are brought to Cabul from Bocharia. The Afghans, who inhabit this province, are a rude and savage race, one tribe of whom dwell in caves, and live by plunder.

In 1809 an embassy was sent from the British government in India to the sovereign of this country, and an alliance was entered into, in which it was agreed that the armies of the Cabul state should oppose the progress of the French and Persians, in case they should attempt a passage to the British settlements, and the expences were to be defrayed by the British state.

CABUL, the capital of the province of Cabul in Afghanistan, stands in a spacious plain, which is well watered by the Cabul and other rivers, and interspersed with walled villages. The city is surrounded by a wall about a mile and a half in circumference, and the houses are built of rough stones, clay, and unburnt bricks. The surrounding territory is occupied by gardens, and excellent fruits are abundant; the great Bazar, or market-place, is frequently crowded with Usbeck Tartars, whose features resemble the Chinese and Malays. The city is also frequented by many Hindoo merchants, who are protected by the government, and contribute greatly to its prosperity. Cabul is 839 miles distant from Delhi, and 1815 miles from Calcutta.

CACHAO, a province and city of Tonquin in Asia. The city, which was formerly the capital of the empire, and the residence of the sovereign, is without walls or fortifications; the streets are generally narrow, and the houses, which are built of wood and clay, are not more than one story in height. The pagodas or temples are on a larger scale, and are not destitute of grandeur. The palace in the centre of the city is an immense pile of building, and, including the gardens, is encompassed with a wall, which comprehends a space three leagues in circumference. That part of the palace destined for the residence of the monarch was adorned with numerous columns of a beautiful kind of wood, with a profusion of gilding; but in some late wars it was reduced to ruins. The population of this city is stated at 40,000; and, from the establishment of an English and Danish factory, it appears that it has some commercial intercourse with Europeans.

CACTUS, a genus of plants belonging to the Icosandria class, and of which some species are not less remarkable for their curious structure, than for their valuable productions. On one species the cochineal insect, of so much importance in the arts, is produced.

CADI, a judge of civil affairs among the Turks, and is generally applied to those who are appointed to decide in such matters in towns.

CADIZ, a city and sea-port of Andalusia in Spain, is about 60 miles S. W. from Seville, and 40 miles N. W. from Gibraltar. It occupies the western extremity of the isle of Leon, and communicates with the land by means of a causeway. It is strongly fortified on all sides, the streets are regularly arranged, though some of them are narrow, and the houses are well-built. Some of the squares are very spacious, and the ramparts afford a delightful walk, and an extensive and diversified prospect. Some of the public buildings are magnificent structures, and some of the churches are adorned with paintings by the first masters, while some of the private citizens can boast of a numerous and splendid collection of the most admired productions of the pencil. The bay of Cadiz, which is about ten leagues in circumference, affords excellent anchorage ground for ships, which are protected on all sides, except the west, where it opens toward the Atlantic, and the entrance is strongly defended by forts. Cadiz has a royal dock-yard, and extensive magazines for all kinds of naval stores. Beside the usual institutions for the ordinary branches of education, academies have been established for those departments of knowledge which are more immediately connected with naval and military affairs.

The population of Cadiz has been variously stated, at 65,000, 70,000, and even at more than 80,000. The tunny fishery, which commences in May, and continues till the middle of June, is the source of a considerable trade between Cadiz and the ports in the Mediterranean and other parts of Europe. The manufactures of this place, which extend only to ribbons, some silk stuffs, and a few linens, are scarcely worthy of notice; but to foreign commerce, and especially to the trade with the American colonies, Cadiz is indebted for its wealth and prosperity. At one period of its history, all the manufactures of the kingdom, destined for the supply of the Spanish colonies, were transmitted through Cadiz; and all the productions of the new world were received into its port in return. But this trade is now shared by other cities of Spain. The trade of Cadiz with European nations, is also valuable and extensive; and many foreigners have factories and resident agents to conduct their business.

CADMUS, in fabulous history, was the son of Agenor king of Phœnicia, and the brother of Europa, who was carried off by Jupiter. Being dispatched by his father in search of his sister, and being disappointed in recovering her, he dared not return to his own country. After various adventures he built Thebes; and he and his wife Hermione, whom he had received from the gods, were changed into serpents. Attempts have been made, by learned antiquaries, to trace the foundation of this fabulous story to some events in real history, for which the reader may consult the works of Bochart and Bryant. To Cadmus is ascribed the introduction of letters into Greece: and hence these letters, which are sixteen in number, are called Cadmean letters.

CADUCEUS, the rod or sceptre of Mercury, which, according to the fable, he received from Apollo, and consists of two serpents twisted together. Great powers are ascribed to this rod by the poets, and among the ancients it was the symbol of peace.

CAEN, a city of Lower Normandy, and capital of the department of Calvados in France, stands in a rich valley at the confluence of the rivers Orne and Odon, is surrounded with walls and defended by a strong castle. Some of the squares are spacious, and adorned with fine houses. The abbey of St Stephen, which is said to have been built by William the Conqueror, is memorable as the repository of the remains of that monarch; the university of Caen, which has been in considerable celebrity, was founded in the fifteenth century by Henry VI. of England.

The population is estimated at 36,000, and the inhabitants are much employed in the manufactures of woollen and cotton stuffs, hosiery, laces, iron ware, and porcelain. The river Orne, which is navigable, affords great facilities for commercial intercourse, both with other parts of France and with foreign countries. At an annual fair, which is crowded with merchants from all quarters, a very active trade is carried on for fifteen days.

CAERFILLY, a small town of Glamorganshire in South Wales, which is chiefly remarkable as a place of high antiquity, and for the ruins of a castle of great magnitude. Many Roman coins are found in the vicinity. The castle is supposed to have been erected about the end of the eleventh century; and the few inhabitants of the place are chiefly employed in the manufacture of pig and bar iron, stockings, and blankets.

CAERLEON, a small town of Monmouthshire, which stands on the banks of the river Uske, and from the numerous remains of altars, pavements, statues, and inscriptions, seems to have been a place of great importance in the time of the Romans. From the early descriptions of this place, it appears that it was greatly distinguished by the splendid palaces and stately edifices which were constructed by the Roman princes; and it was furnished with baths, temples, and theatres, the remains of which exhibit striking proofs of Roman magnificence. The number of inhabitants scarcely exceeds 700, and they are chiefly employed in the tin-works for the manufacture of tin-plates.

CAERMARTHENSHIRE, a county of South Wales, having St George's Channel and Pembrokeshire on the south and west, and the counties of Cardigan, Brecknock, and Glamorgan on the north and east, presents in general a hilly aspect, and on the north and east rises into a mountainous elevation. It is intersected with numerous narrow vallies, and the vale of Towy, 30 miles in length, is celebrated for its picturesque scenery, some parts of which, as Grongar hill, have obtained classical fame. The Towy, the Taw, the Cothy, the Dulas, and the Gwilly, are the principal rivers, some of which abound with trout and salmon. Limestone is abundant, and mines of lead, iron, and coal, furnish employment to a great number of the inhabitants. The soil in some places is very fertile, and yields sufficient crops of oats to admit of some exportation; the more elevated tracts yield excellent pasturage, and a good deal of the produce of the dairy is exported. The number of inhabitants exceeded 67,000 in 1801, and had increased to more than 77,000 in 1811. Remains of ancient roads and camps, and numerous silver coins, which have been discovered in different places, shew that this country was occupied by the Romans.

CAERMARTHEN, Town of, the capital of the county of the same name in South Wales, stands in a rich valley on the north side of the river Towy, consists of numerous streets, and contains many well built modern houses. In ancient times it was defended by walls and a strong castle. The number of inhabitants in 1811 exceeded 7000. Tin-plate and cast-iron are the chief manufactures, which, with rope-making and ship-building, furnish the chief employment to the inhabitants. Caermarthen is about eight miles from the sea, but the navigable river admits vessels of about 100 tons burthen, and affords the means of carrying on a considerable coasting trade. This town is memorable as the birth-place of Merlin Ambrose, the famous conjurer or magician, and Merlin's grove, and a rock called Merlin's chair, are still pointed out.

CAERNARVONSHIRE, a county of North Wales, has for its boundary on the east Denbighshire, and the sea on all other sides, is remarkable for its mountainous scenery, in which the lofty Snowdon is most conspicuous. Three ranges of mountains, divided by fertile vallies, traverse the county, and the more elevated range is covered with snow during a considerable part of the year. Snowdon rises to the height of more than 3500 feet above the level of the sea, and the height of the stupendous promontory of Penmaenmaur is about 1550 feet. The principal rivers are the Conway and Seiont; the first rising in a lake proceeds in a northerly course to the Irish sea, and the last having its source among the mountains around Snowdon, falls into the straits Menai, at the town of Caernarvon. The strata of this country belong to the primitive class of rocks, and are chiefly composed of granite, micaceous, and burgelaceous schistuses, of which the latter furnishes immense quantities of roof slate for exportation. Lead and copper mines have also been wrought in the mountains.

The extent of this county is estimated at 45 miles in length, and 12 or 14 in breadth, and, with a surface of more than 300,000 acres, little more than one-half is fit for cultivation, or even pasture land. The population in 1801 was stated at 41,521, and had increased to more than 49,000 in 1811. The county is divided into ten hundreds and 71 parishes. Bangor and Caernarvon are the chief towns. The shores abound with fish, particularly with herrings, lobsters, and oysters. Grain is cultivated in the vallies and flat districts near the sea; and oats and barley, with the produce of the dairy, and black cattle, are exported. A bold undertaking, of recovering between three and four thousand acres of land from the sea, at the bottom of the bay of Cardigan, commenced about the year 1808. The embankment constructed for this purpose is twelve yards wide at the top; and to prevent the materials of which it is composed from sinking into loose sand, a thick matting of rushes, secured by stakes, was laid.

CAERNARVON, town of, the capital of the county of the same name in North Wales, occupies a pleasant situation, which is nearly peninsular, opposite to the isle of Anglesea; consists of regular streets and well-built houses, contains about four thousand inhabitants, and has a considerable trade with the chief ports of England and some parts of Ireland. The ruins still visible, indicate that it was once a Roman station; and a strong castle, with many towers, shews that it was a place of great importance in the early period of English history. Caernarvon is much resorted to in summer for sea-bathing. Visitants have the advantage of hot and cold baths, and the vicinity affords delightful walks and highly picturesque scenery.

CAERWYS, a town of Flintshire, which seems to have been once a Roman station, and was memorable at a later period for an annual meeting of bards and minstrels, which becoming a lawless scene of tumult and disorder, was suppressed in the time of queen Elizabeth. This place was also at one time famous for its fairs of cattle, sheep, and horses; but the population is now under 800, and no activity or industry promises to revive its declining fortunes.

CÆSALPINIA, a genus of plants belonging to the Decandria class, and of which one species, the Brazil-wood, is much employed as a dye-stuff. See Botany.

CÆSALPINUS, Andrew, a celebrated Italian naturalist and physician, was born at Arezzo in Tuscany, in 1519. Of his early education scarcely any thing is known; but such was his reputation for medical knowledge, that he was appointed physician to the pope, which situation he held during the latter years of his life. His studies were directed to the philosophy of the times, as well as to those branches of knowledge more immediately connected with his own profession. But he is most celebrated as the author of a treatise on botany, which was published at Florence in 1583, and is the first attempt of the systematical arrangement of plants. He also published a treatise on metallic substances; and he died at Rome in 1603, when he had reached the venerable age of 84.

CÆSAR, Caius Julius, the first Roman emperor, and one of the most conspicuous characters in Roman history, was descended of the Julian family, which boasted of high antiquity, and at last became illustrious by the splendid panegyrics of the orators and poets of the classic age of Augustus, who were anxious to secure the favour of that monarch. The early youth of Cæsar was distinguished by profligacy; but even then his aspiring ambition was not overlooked. When he was only in his 17th year, he was chosen priest of Jupiter. To follow out his ambitious views, he spared no expence in cultivating the favour of the people, by the exhibition of all kinds of public entertainments. After a severe struggle with some persons of the highest influence, he succeeded among powerful competitors to be elected high priest. He rose afterwards to the office of prætor; and on the expiry of his office he was appointed to the government of Lusitania. The next step to power was the consulship, which he obtained chiefly through the influence of Pompey and Crassus, of the rivalship between whom he had the address to effect a temporary cessation; and to secure more strongly the friendship and influence of Pompey, he gave him his daughter Julia in marriage, while he indulged the vanity and avarice of Crassus by granting him a lucrative appointment. The campaigns of Cæsar in Gaul gave high celebrity to his military reputation, and led the way to the unbounded power at which he aspired. With an army devoted to his interests at his command, Cæsar had renewed his alliance with Pompey and Crassus, and with these powerful men had formed a plan for the partition of the empire. But during his first expedition to Britain, his daughter Julia, the wife of Pompey, died; and from this time, it would appear, Pompey and Cæsar began each to consult his own individual interests.

The intrigues and violence of parties produced great disturbances in Rome; the appointment of a dictator was proposed to suppress the outrages; and Cæsar, during his absence, was nominated by his friends to the consulship. This was the commencement of the severe struggle between Pompey and Cæsar, in which the latter was successful, and finally triumphed over his rival, whom he defeated in the battle of Pharsalia. Pompey fled to Egypt, where he was followed by Cæsar, but he had previously fallen by hands of assassins. Cato, with the fleet and the remains of the army, directed his course to the Roman province of Africa, and with the assistance of Juba, the king of Numidia, seemed still able to make a formidable resistance; but he was at last defeated, and seeing no hope of resisting the power of Cæsar, he resolved by a voluntary death to secure himself from being the victim of his ambition.

Cæsar was now in reality the ruler of the empire; he received every mark of servility from the senate and people at Rome, whom he amused with the most expensive and most magnificent entertainments. On one occasion a crown was offered him; but no marks of applause having followed from the people, he pushed it away with his hand. A conspiracy was at last formed against his life, and he fell in the senate-house, at the foot of Pompey's statue, being pierced with 23 wounds. Of the military career of this extraordinary man, the best record is to be found in his Commentaries, composed by himself, and remarkable for simplicity and purity of style; and the political events in which he was concerned form a striking feature in that period of Roman history.

CAFFA, or KAFFA, which is supposed by some to be the ancient Theodosia, is a sea-port town of the Crimea, and is situated on an elevated spot, which forms an amphitheatre round a spacious bay. For several centuries after the 13th, when it fell into the hands of the Genoese, it enjoyed a large share of commercial prosperity; but its trade afterwards declined, and it is now reduced from a crowded population to about 100 houses. Caffa, with the rest of the Crimea, came under the dominion of the Russians in 1783.

CAFFRARIA, an extensive region of Southern Africa, which lies between the 20° and 25° of south latitude on the west, and between the 24° and 32° on its eastern boundary. The country towards the east is rich and fertile, the mountains are clothed with forests, and the plains are well watered by numerous streams, and produce a luxuriant vegetation; but the western districts present nothing but a perfect desert. This country has been rarely visited by Europeans. The general denomination of the inhabitants is Caffres, and they are quite distinct in their appearance and character from the Hottentots on the south, and the negro tribes on the north. They are governed by independent chiefs, who, by a kind of tacit consent, it is said, acknowledge one as their sovereign. Agriculture is not very extensively practised, for their chief wealth consists in cattle. Considerable towns have been discovered in some parts of this country, and particularly the town Leetakoo, which was visited in 1801 by commissioners appointed by the colonial government at the Cape, and more lately by Mr Campbell, a missionary traveller. See Barrow's *Travels in Southern Africa*, and Campbell's *Travels.*

CAGLIARI, the capital of the island of Sardinia, stands on the southern side of the island, and at the bottom of a spacious bay, from which it exhibits a picturesque appearance on its elevated situation. It is defended by a castle and fortifications, and is divided into the upper and lower town. The cathedral is a magnificent edifice, besides which there are numerous churches and convents. The population is estimated at 30,000. But, with the advantage of an excellent harbour, the trade is said to be extremely limited.

CAHORS, the chief town of the department of Lot, in France, occupies a peninsular spot formed by the river Lot, is irregularly built, with narrow streets, and is fortified with strong walls. The remains of Roman architecture are still visible in the neighbourhood. The cathedral is an ancient structure, adorned with a cupola. The university, which was founded in the beginning of the 14th century, was incorporated with that of Toulouse in the middle of the 18th, but an academy and lyceum still exist.

The population is estimated at 12,000. Some kinds of woollen stuffs are manufactured; but the chief source of the trade of Cahors is in the produce of the vineyards of the surrounding country. The wine is highly esteemed, and a great quantity is carried down the river to Bourdeaux for exportation.

CAIFA, or CAIPHA, a sea-port town of Palestine, at the foot of mount Carmel, and separated from Acre by the bay of the same name. The houses are small, flat-roofed, and irregularly distributed. The trade of this place has increased since that of Acre, in consequence of its port being choked up, has declined. The inhabitants are chiefly Mahometans, Catholics, and Greeks; and the pilgrims who visit the church upon mount Carmel are subjected to a certain tribute. Caifa is eight miles south-west from Acre.

CAIMAN, or CAYMAN ISLANDS, are two small islands which lie to the north-west of Jamaica, on one of which, called the Great Cayman, a few inhabitants reside, and are chiefly occupied in the turtle fishery, from which the markets of Jamaica, and ships on their homeward-bound voyage, which touch at these islands, are supplied with turtle.

CAIRN, is a collection of stones thrown together in a conical form, and common in many parts of the world, particularly in Scotland and Wales. Cairns are distinguished from barrows, from the first being composed of stones, and the last of earth; but whatever were the materials, the original object of these structures seems to have been for a memorial of remarkable events. They were afterwards employed as places of sepulture for distinguished persons, and in some cases they seem to have been intended for religious purposes, or as a kind of rude temple. In some of these cairns which have been examined in Scotland, nothing different from the stones of which they are composed was found, from which it would appear that they were intended as monuments of some remarkable event; but, in other cases, warlike instruments, ornaments of dress, and urns containing ashes, sufficiently indicate that they are the tombs of celebrated warriors. The magnitude of the tumulus, or cairn, was regarded as a mark of respect, and hence the proverb, "I will add a stone to your cairn," which is still prevalent among the Highlanders of

Cairo. Scotland, is considered as an expression of regard to the memory of the dead. But among the same people it is not unusual for the passing traveller to add a stone to the heap which is intended as a memorial of the spot where a murder has been committed, or some disastrous calamity has happened.

CAIRO, or GRAND CAIRO, and sometimes called the Queen of Cities, stands on the eastern bank of the Nile, a little above the Delta, or plain of Lower Egypt. It was founded in the 10th century, according to oriental writers, and received its present name, which signifies Victorious, from Moaz, the first caliph, in memory of his conquest of Egypt, Having transferred the seat of empire from Barbary to Fostat, the capital of Egypt, he erected a splendid palace in its neighbourhood; but two centuries elapsed before Cairo could boast of any thing more than being the residence of the sovereign and his attendants, and a station for his soldiers. On the invasion of Egypt by the Christians in the time of the Crusades, the capital Fostat was reduced to ashes, to disappoint them of their expected booty; and the inhabitants who survived the calamity sought an asylum in Cairo, which from that period became the capital. Cairo was enlarged, adorned, and fortified, by the famous emperor Saladin. It was in the height of its prosperity about the commencement of the 15th century; was then a central position for the trade of Europe and Asia, and was still respectable for men of learning. But the conquest of Egypt by the Turks, and the discovery of a passage to India by the Cape of Good Hope, threw this flourishing trade into a different channel, and caused the decline of this rich city.

Cairo, which is still a large city, is described as being equal in extent to Paris. Arranged in somewhat of a crescent form, it is more than nine miles in circumference, and seen from the Nile, from which it is little more than a mile distant, it presents a most magnificent scene, in which the citadel, innumerable lofty edifices, and countless minarets, rising as it were from a grove adorned with the richest foliage, are the most conspicuous objects. But a nearer approach affords a less pleasing view. The streets are crooked, narrow, and unpaved; and with the crowds of men and animals, which are continually passing along, are extremely disagreeable, from the dust and filth. The houses are generally of wood, or unburnt bricks dried in the sun, and consist only of a single story; but the mansions of the grandees are large and commodious, and are constructed of a soft kind of stone. The houses are crowded together into groupes, with large intervening spaces, which, as well as the courts and gardens within the walls, are covered with water in the time of the inundation of the Nile. Among the public structures of Cairo, the reservoirs for water and the baths are remarkable for their elegance, and the warehouses for merchandise, as well as the market-places, are spacious and commodious; but the mosques, of which more than 300 are erected within the walls, form, with their numerous and lofty minarets, the chief ornament of the city. Beside the mosques, the Jews have a synagogue, and the Greeks and some other sects of Christians have also places of worship. The citadel, which is elevated on a rock, is three miles in circumference, and affords one of the most splendid views in Egypt. It includes the palace of the pacha, the barracks of the janizaries, and some remains of antiquity; among which, Joseph's well, dug to the depth of 276 feet through the solid rock, is a remarkable specimen of ancient art. The diameter of the well varies at different depths, and where it is contracted, stages are formed for oxen to drive a wheel for raising the water. A huge pile of building within the citadel is called Joseph's palace, the great hall of which, adorned with massy pillars and arches for supporting its spacious roof, has been greatly admired. Cairo.

Boulac, which is about a mile to the west of Cairo, on the right bank of the river, may be considered as its principal port, enjoyed at one time great commercial prosperity; but it suffered severely from the French, who plundered and burned it to the ground. About a mile distant also, and higher up the river, stands Fostat, formerly the capital of Egypt, and still a populous place. The great canal, which formed a communication between the Nile and the Red sea, passes off from the river near this place, and proceeding towards Cairo divides the city into two parts, and when it is filled with water supplies all the ponds and reservoirs.

On the island of Rhoda, a charming spot in the middle of the river, is erected the celebrated Mikias or Nilometer, or measurer of the Nile. The object of this structure is to ascertain the rising of the river during the annual inundation. It is composed of a magnificent marble pillar, surmounted by a Corinthian capital, which rises from the centre of a basin having a communication with the Nile, and being graduated, indicates the increase in the height of the river. A splendid dome, supported by columns, is erected over the pillar. This building is said to be nearly 1000 years old. As the fertility of the soil depends on the waters of the Nile during the inundation, great attention is paid to their increase, and the instrument is carefully watched during that season by a proper officer; and when they have risen to a sufficient height, the canal is opened with great ceremony, in presence of the beys and the whole court, and an immense concourse of the inhabitants of the city.

The population of Cairo has been variously stated at 250,000,—300,000, and even as high as 700,000; and it is composed of people of all countries and religions. All the luxurious manners and customs of eastern regions prevail among those who have it in their power to indulge in them. Sailing on the Nile is one of the great amusements of the inhabitants of Cairo, and vessels of a light construction are elegantly fitted up for these aquatic excursions.

The Turkish government is little favourable to the prosperity of the arts and manufactures. Some silk stuffs, linen cloth, the manufacture of sugar, of sal ammoniac, saltpetre, and coarse gunpowder, with glass lamps, and some kinds of leather, are all that occupy the industry of the inhabitants. The mode of hatching chickens by means of artificial heat, which has been long known in Egypt, is still practised at Cairo. This celebrated city possesses peculiar local advantages for commerce; and accordingly it has been, from the earliest times, the central emporium of trade for Europe and the western parts of Africa on the one hand, and Abyssinia, Arabia, and India, on the other. Every year a caravan arrives from Abyssinia loaded with the rich productions of the interior of Africa, and being joined by another caravan from the western parts of Africa, it proceeds towards Arabia. This perilous journey is undertaken partly for religious and partly for commercial purposes, and having performed the prescribed ceremonies at the holy city, and exchanged their merchandise for the valuable commodities of the east, the immense body of travellers, amounting, it is said, sometimes to 100,000, return from Mecca by the same route.

CAITHNESS, a county of Scotland, which has for its boundaries on the north the Pentland frith, on the east and south the German ocean, and the county of Sutherland on the west, is about 35 miles in length, and about 20 in breadth, and includes an area of nearly 700 square miles. Great part of the sea coast is rocky and indented with numerous bays. Duncan's-bay-head, which forms the north-east point of Caithness, is the most northerly promontory in Great Britain. The eastern districts of the county are level, and watered with rivers and lakes, but on the west side it is hilly and mountainous, and fit only for pasturage. The strata of Caithness are composed chiefly of primitive rocks. Some indications of iron, lead, and copper ores have been observed, but not in such abundance as to afford profit in working. Limestone and marl are abundant; but the discovery of coal has been attempted with no prospect of success. Many ancient castles still exhibit their mouldering remains in this country, and the Picts' houses, peculiar structures, somewhat of a conical form, and remarkable for the thickness of their walls, still exist to exercise the ingenuity of the antiquary.

The population of Caithness, in 1801, amounted to 22,609, and in 1811 had increased to 23,419. The improvements of agriculture have not been neglected, and excellent crops of barley and oats are obtained. A great number of cattle was annually reared and sent to the markets in the south; but sheep-farming is now more prevalent in the higher districts of the county. The herring fishery on the coast is sometimes abundant and successful, and the caverns along the shore afford opportunities of taking great number of seals. Numerous sea-fowl hatch in the rocks, and furnish a supply of food to the inhabitants from their eggs and young. The spinning of linen yarn, and the making of leather, are almost the only manufactures of the county.

CALABRIA, a district of the kingdom of Naples, which consists of two provinces, Hither and Farther Calabria, of the latter of which Reggio is the capital, and Cosensa of the former. See NAPLES.

CALAIS, a sea-port town, and chief place of a district in the department of the Straits of Calais in France, stands on marshy ground, is surrounded by a moat and wall, and is defended by a citadel. The streets are pretty regular and well paved, and the houses are well built. The arsenal, theatre, a large hotel, with some churches and monasteries, are the chief public edifices. The harbour, formed by a small stream, is greatly incommoded with sand-banks. The population is about 8000. Stockings and soap are said to be the only manufactures; but the herring, cod, and mackerel fisheries are considerable; the coasting trade is lucrative, and a great deal of business is done at the fairs in January and July, which continue each for about ten days. Calais being the thoroughfare between France and England, is a place of great resort in time of peace by the natives of both countries; and the mail is regularly conveyed twice a week between Calais and Dover.

CALAMINE, an ore of zinc, composed of oxide and carbonate of zinc. See CHEMISTRY and GEOLOGY.

CALCUTTA, the capital of Bengal and of the British territories in India, stands on the eastern branch of the Hooghly, and stretches about three miles along the river. Calcutta, comparatively a modern town, having risen to its present extent and population in the course of the 18th century, is distinguished into the Black town and that which is inhabited by Europeans. The houses of the latter are entirely of brick, covered with a peculiar kind of mortar made of shells, which has all the appearance of fine marble, are in detached situations, and have spacious and lofty apartments. In the Black town the streets are narrow and crooked, and the houses are constructed of brick, mud, or bamboos and mats. Of the public buildings, the citadel and the government-house are by far the most conspicuous. The former stands about a quarter of a mile from the city; is on a very large scale, and includes bomb-proof barracks fit to accommodate 10,000 men. The esplanade, between the city and Fort-William, is the morning and evening resort of the inhabitants, and is crowded with all ranks and descriptions of persons, who frequent it for exercise and recreation. The new government-house on the west side of the esplanade is a most magnificent edifice. To these may be added, the court-house, the Armenian, the episcopal, and presbyterian churches. Calcutta is now the see of a bishop, as well as the residence of the governor-general.

Various benevolent institutions have been established and liberally supported; among which are enumerated a free-school, schools for the education of orphans of the privates and officers in the military department of the company, and an hospital for the sick of the native inhabitants. The attempt to establish a college on the plan of similar institutions in Europe has not succeeded. All that is retained of the establishment is limited to three teachers of the native languages. This termination of the undertaking was predicted by an intelligent observer, Dr Tennant, who remarks, that "as it is for business, and not education, that young men are sent to India, it is difficult to foresee any benefit that will ever result from this measure. Instruction in the native dialects is, in general, all that is necessary to qualify them for the exercise of their duty; and this they have hitherto received from moonshees or interpreters, at the spare hours that are not employed in their different vocations." The Asiatic Society, instituted in 1784, by Sir William Jones, for the purpose of investigating the history, literature, and antiquities of the country, still continues to flourish.

The population of Calcutta was estimated some years ago, when a famine prevailed, and had reduced its numbers, at half a million; but, according to later statements, it is said to be nearly equal to 700,000. Calcutta is a place of immense trade. Ships of all nations frequent its port to carry off the rich productions of Bengal and the interior regions of India, in exchange for money or the superfluous commodities of the countries to which they belong.

Calcutta was selected in 1690 by Mr Charnock, the agent of the East India Company, as the most convenient spot for the establishment of a factory. The affairs of the settlement continued to prosper till after the middle of the 18th century. A new native sovereign, in hopes of rich plunder, resolved to expel the English from the country. He attacked Calcutta with an immense force; and the besieged, being few in number, and with scanty ammunition, were at last overpowered and made prisoners. But of 146 persons of both sexes, who were crammed into a dungeon called the *black hole*, including a space of only 18 feet square, and were kept a whole night in this miserable situation, twenty-three only survived the cruel calamity. Mr Holwell, the commander, was one of the survivors, and afterwards published a melancholy relation of the barbarous transaction, and erected an elegant obelisk near the spot to the memory of his fellow-sufferers, whose names it records. This dreadful event happened in the year 1756.

CALEDONIA, the ancient name of Scotland, or of part of that kingdom, for the industry and researches of antiquaries have not been able to fix its precise limits. According to some, ancient Caledonia included that part of Scotland which lies to the north of the Forth and the Clyde, while others extend it to the whole of Scotland. For an account of Caledonia, and of the struggle which the inhabitants maintained with the Romans, see *Tacitus* and Mr Chalmers' *Caledonia*.

CALEDONIA, NEW, a large island in the Southern Pacific ocean, which lies between south latitude $19\frac{1}{2}$ and $22\frac{1}{2}$, and $163\frac{1}{2}$ and $167°$ of east longitude; about 300 miles in length, but not exceeding 30 miles at its greatest breadth. A chain of mountains runs through its whole extent, rising in different ridges from 2000 to six or 7000 feet from the level of the sea. The coast is generally bold, and is defended by numerous rocks and sand-banks, and hence navigation is attended with considerable danger; and these difficulties in approaching the island, render the utmost vigilance and precaution necessary. The rocks, as far as Europeans have had an opportunity of examining them, are chiefly of the primitive class. Some ores of iron were observed, but no volcanic productions were seen.

The inhabitants of this island appear to be a robust, active people. Their houses, constructed of wood, reeds, and coarse grass for thatch, are of a circular form. Fishing is their chief employment; and this produce of their industry, with a few roots which they cultivate, forms their chief subsistence. The country is divided into different districts, each of which is governed by its own chief. This island was first seen by captain Cook in 1772, and has been since visited by the French navigators.

CALENDAR, or KALENDAR, a register of time, or of particular events. For the method of adjusting the artificial division of time, to make it correspond with the revolutions of the heavenly bodies, see ASTRONOMY.

CALENDAR, when employed as a law term, signifies a list of prisoners who are in custody of the respective sheriffs, and are to be brought to trial for their crimes at the assizes.

CALENDAR OF FLORA, is a register of the times in which plants of any particular district germinate, unfold their leaves, or shed their leaves and flowers, and ripen and disperse their seeds.

CALENDER, from the French *Calendre*, an engine for smoothing or putting a gloss upon cloth. In a more extended sense, a calender is a place where cloth is smoothed, lapped, and packed, previously to its being sent off to the market. The object of calendering is to give the cloth a more kindly feel, to make it appear of a finer texture, and, by condensing it moderately in a press, to pack in less bulk than in the uncalendered state. Some kinds of goods are not put through the calender; they are merely folded in the state they came from the bleachfield; and in such cases the goods are said to be soft dressed. Hard dressing signifies that they have been submitted to the operation of the machinery.

Besides the improvement in the appearance of the cloth resulting from the processes of calendering, the variety of forms into which it is folded, and the ornaments peculiar to each species, are of the highest importance in a commercial point of view; for, as the greatest part of our goods are merely imitations of the manufactures of other countries, it is still found necessary, when we send them in competition to foreign markets, that not only the original names be retained, but that their peculiar lengths, folds, and ornaments, should likewise be scrupulously observed; for a copious list of which, see the Table subjoined to this treatise.

The mechanical processes of calendering are of two kinds; one consists merely in smoothing the surface of the cloth, by passing it through between the rollers of the machine, previously heated with steam or iron heaters; the other, by means of friction, excited by the machinery, gives to the surface of stout fabrics a lustre, or very fine polish, which is known by the name of glazing.

The principal apparatus employed for these purposes is represented in Plate 38. Fig. 1. is a front elevation of a five cylinder or bowl calender, the end, or side of which, together with the wheel-work, is exhibited in Fig. 2. A, B, C, D, and E, Fig. 1. are the five bowls or cylinders, between which the cloth passes in the operation of calendering. The cylinders B and D are made of cast-iron, accurately turned and polished, and left hollow within, like a pipe, for the reception of the iron heaters or steam. The rollers A, C, and E, are made of paper, and are interposed, alternately, between the metallic rollers, on account of their elasticity, as the surfaces of two iron cylinders coming in contact would injure the cloth in passing between them.

These rollers are constructed in the following manner: A square axle of malleable iron is prepared, on which a number of circular pieces of pasteboard, with square holes cut in their centres, are placed, and which are rather larger in diameter than the intended size of the roller, to make allowance for turning and polishing. When a sufficient quantity of the pasteboard is thus applied to make the roller the requisite length, four iron rods are again run through it, parallel to the axis, on the ends of which is screwed a circular plate of iron, at each end of the roller, by means of nuts, as represented in the fig. In order to give the paper a sufficient degree of compression, so as to render it one solid mass, the roller is put into a stove, and exposed for several days to a strong heat, during which time the screws are frequently tightened, until the paper is as much compressed as possible. When the roller is removed from the stove, and left to cool, the pasteboard, by again endeavouring to expand, forms a most solid and elastic substance, which, when accurately turned in the lathe, and well polished, is found to be superior to any materials that have yet been discovered for this purpose.

The bowls or cylinders being thus prepared, the several dimensions of which, for a well going calender, are pretty accurately exhibited in Fig. 1; they are lodged in a strong cast-iron frame, similar to that represented in the plate. At each end of the frame is an apparatus *a*, *a*, connected to the cross-bar F, for occasionally raising or separating the rollers when the metallic ones become too hot, or when the machine is not working. This apparatus is raised and lowered by turning the screws *b* and *c*, the cross-bearers being placed at different distances from the ends of the metallic cylinders, by which the upper one is raised first, to make way for those below. They also raise the end of a wedge, which is introduced below each journal of the paper-roller C; but the pillows of the upper roller, A, are connected, directly, to the lower ends of the screws *b* and *c*, by means of which the rollers may all be separated from each other to equal distances, or their surfaces brought into contact at pleasure. In the end, *g*, of the cylinder B, an aperture is left, sufficiently large to receive the iron heaters, a small hole being only necessary in the other end for pushing them out, when required, by an iron rod. The cylinder D is adapted to steam, which is transmitted through the pipe *d*, and the condensed vapour is let off by the pipe *e*. Steam appears to have been first applied to the heating of calenders about the year 1805, by the late Mr John Millar, Ayton-place, Glasgow; and is found to be a very great improvement, not only as it saves time and fuel, but in meliorating the appearance of the goods. *Buchanan on Heating by Steam*, p. 208. Some calenders, however, are still heated with the iron heaters, some wholly with steam, and others are adapted to both.

The relative situation of the wheels for driving the calender will be seen in Fig. 2. The wheel 1. is the driver, which is put in motion by the power of horses, water-wheel, or steam-engine. It works into the teeth of the wheel 2, or the axle of the cylinder B. fig. 1. which is all the wheel-work requisite on the rollers of a common calender; for the other rollers revolve merely by friction, equal portions of their surfaces coming in contact in equal times. But as it is often necessary to change the motion of the calender while at work, an additional apparatus is employed for this purpose, which is represented in Fig. 3. A, is the lying shaft, which is kept in motion by the engine or other power; B, part of the shaft *b*, Fig. 1. which turns the driver 1. The two level wheels, *a* and *e*, having circular bushes, are loose upon the lying shaft A. The clutch *i*, is carried round with the shaft by means of a feather, which slides in a groove cut in it below the clutch-box. Hence, when the clutch *i* is thrown into the arms of the wheel *a* by the lever *o*, the calender is put in motion in one direction; but when it is thrown into the arms of the other wheel *e*, the motion is reversed. The calender is stationary when the clutch is disengaged from both wheels.

Calenders are now generally so constructed, that they may, with very little trouble, be occasionally converted into glazing engines. This is effected by fixing a wheel on the axle of the metallic cylinder D, of a greater diameter than that on the cylinder B, and conveying the motion from the latter to the former, by means of an intermediate wheel 3. The velocity of the two metallic cylinders, therefore, will be in the reciprocal ratio of the diameter of the wheels on their respective axles. Hence, the slow motion of the cylinder D, added to the inertia of the paper roller C, generates a friction or *rub*, between the latter and the cylinder B, which glazes the surface of the cloth submitted to their action.

For this invention we are indebted to the late Mr John Millar, already mentioned, who farther extended the principle to the construction of an engine capable of glazing two pieces of cloth at the same time, while, in every other respect, it answers all the purposes of a calender. Fig. 4. is a section of this engine, exhibiting the diameters of the bowls or cylinders, and the number of teeth in the different wheels. In this machine are three metallic cylinders, between which are interposed two paper ones, which are distinguished by being lighter shaded than the others, the wheels being represented by dotted circles. When this engine is employed as a common calender, the centre wheel only, of 33 teeth, is acted upon by the power, the two intermediate wheels of 28 teeth being removed, and the other bowls revolving by friction, as in the one already described. As the diameter of the cylinder B, however, is only $10\frac{1}{2}$ inches, and that of G 15; and since their circumferences are as their diameters, it will be $\frac{15}{10.5} = 1.43$, for the times that B should revolve while G revolves once, that their surfaces may move through equal spaces in equal times. But when the intermediate wheel of 28 teeth is applied, the motion is communicated from the wheel of 33 teeth to the large one of 65, on the axle of the cylinder G; and, therefore, $\frac{65}{33} = 1.97$, is the ratio of the times in which they now revolve; which multiplied into the circumference of the cylinder B, viz. 33, gives 64.984, or 65, for the space, or number of inches, which the circumference of B moves through, while that of G moves only through 47.124. The difference of these velocities, therefore, produces the friction or *rub*, which converts this part of the calender into a glazing engine. The under part of the calender is exactly the same as that now described; which gives it double the efficacy, as a glazing engine, of those in general use. The portions of this engine, together with the drawings, Figs. 1 and 2, with the exception that one of these cylinders is adapted to iron heaters, were taken from two calenders constructed by Mr Millar, now the property of his successors Messrs Hunter and M'Ilwham, and which do not appear to have been yet surpassed, in the neat and expeditious manner of executing their work, by any modifications that have since been made of his principle.

Besides the five-bowl calender we have described, there is another in pretty general use, containing three bowls only, and which has likewise been converted into a glazing engine, by the application of additional wheel work. In the three-bowl calender, a section of one will be found in Fig. 5, the centre cylinder only is of metal, the other two being made of paper. On the centre cylinder is a wheel of 69 teeth, which, together with the driver, is all that is necessary for the common process of calendering. But, in order to adapt it to glazing, there is a rack of 52 teeth fixed round the end of the lower bowl, into which an intermediate wheel of 22 teeth works; and this wheel, again, is driven by a pinion on the axis of another wheel of 43 teeth, which is driven by the large wheel of 69, on the axle of the metallic cylinder. This train of wheel-work, which is represented by the circles in Fig. 5, diminishes the velocity of the lower bowl, and produces the rub on the surface of the centre cylinder.

It may be necessary here to observe, that in the simple process of calendering, the end of the piece of cloth is entered, in the five-bowl calender, Fig. 1. between the rollers A and B, returned between B and C, entered again between C and D, and returned finally between D and E. In the three-bowl calender, however, it only passes through above the centre cylinder and returns below it. In the process of glazing, the cloth passes between those rollers only which produce the rub.

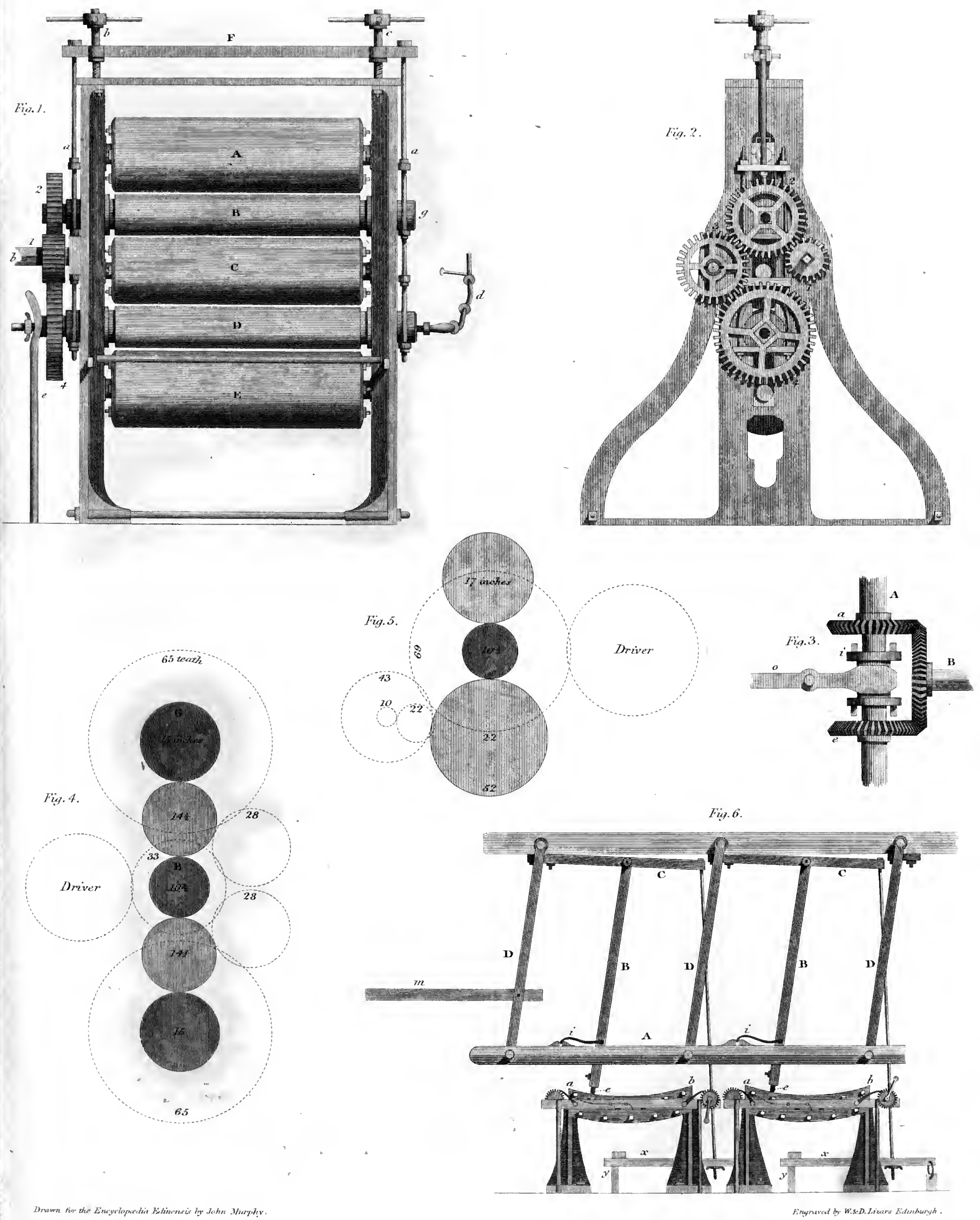
The invention of the rub calender, though one of the greatest improvements that have been made in the business, has not been able entirely to supersede the use of flint in the process of glazing; and the reason assigned is, that the beautiful gloss or polish, given to the cloth by the smooth surfaces of the warm cylinder, is liable to lose its lustre by the smallest damp or exposure to the air, while that given by the strong attrition of the flint is permanent under similar circumstances. Engines for this purpose, therefore, still form a part of the apparatus of almost every calender. Where these engines are employed, a number of them are usually connected together, and the whole driven by a crank, or any other means of applying power that may suit the situation in which they are placed. An elevation of two of these engines, which exhibit their connection, will be found in Fig. 6. *a*, *b*, is a table on which the cloth is spread while under the operation of the flint. This table, which is only about five or six inches broad, is composed of pasteboard, strongly compressed by screws between two iron plates, forming an elastic substance, similar to that of the paper bowls. The flint, *e*, is fixed by a screw into the lower end of the bar of iron B, which is connected to the wooden spring C, by a joint on which it oscillates. The flints are driven from *a* to *b*, alternately, by two parallel bars of iron A, between which they work, and to which they are attached, or from which they may be disengaged at pleasure by the catch *i*. These bars receive their motion from the shaft *m*, which is driven by a crank, or otherwise connected to the power.

When the cloth is to be submitted to the operation of glazing, the flint is brought into contact with the table, by pressing down the lever *x* with the foot, and placing it below the catch *y*; and the rub is adjusted by a screw on the rod which connects this lever to the spring C. The cloth being previously rubbed over on one side with wax, is wound on a small roller in an iron frame, at one end of the table, and is received on another at the opposite end; and the person who attends the machine, moves the frame across the table, and exposes a new portion of the waxed surface of the cloth, at each double stroke, to the action of the flint. A machine has also been invented for waxing the cloth in passing through the glazing engine; but this has now fallen into disuse, and the wax is rubbed over the surface of the cloth simply by the hand.

Having explained the mechanical processes of calendering, and the machinery by which they are conducted, what remains of the business consists chiefly in folding, pressing, ornamenting, and packing the goods, in a manner suitable to their different qualities, or to the several markets to which they are destined. Muslins were formerly put through a small calender made on purpose for these fabrics, but they are now folded in the state they come from the bleachfield. Besides these goods, Madras pullicats, Bandanas, York stripes, jeans, and jeannets, dimities, prince's cord, &c. are also dressed soft; ginghams and printed calicoes are sometimes dressed soft and sometimes glazed. Checks, made up as listadoes, brown linens, white cotton platillas, rolled checks, and some others, are prepared by damping, and letting them lie in that state about six hours. When dry, and put through the common calender, the outer yard or fold is rubbed over with paste made of flour or size, and again left to dry. After this the pasted fold is put three or four times through the rub-calender, backward and forward, which gives a highly finished gloss to that part of the piece which is exposed to view when folded.

After the goods have been made up into their respective folds, they are set into the press, with a smooth board between every one, two, or three pieces, according to their qualities; and frequently a sheet of glazed pasteboard is laid next the outer fold of each piece, to give it a more glossy appearance. They are allowed to remain in the press for a few hours, less or more, as the time will permit. The common screw press, similar to that represented in the plate, on Bandana manufacture, was universally employed in calenders until the invention of the hydrostatic press by Mr Bramah. But since the great power and

CALENDER.



Drawn for the Encyclopædia Edinensis by John Murphy.

Engraved by W.&D. Lizars Edinburgh.

facility of working this engine have become generally known, it has almost entirely superseded the other, not only in our calenders, but in all other public works where a great pressure is required.

When the goods have been folded and ornamented, as directed in the following table, they are then ready for packing. For the London and American markets they are packed in small lots of about a dozen pieces each, but for the West Indies they are merely packed in boxes or trunks previously well lined with paper.

TABLE of the Lengths of the different kinds of Goods *as they are prepared for the Market, the manner in which they are Folded, and the Marks or Ornaments attached to them.*

Names.	Length.	How Folded.	Ornaments, &c.
Muslins . .	10, 12, or 20	$18\frac{1}{2}$ by 13	No ornament, only a ticket with the length.
Bandanas . .	13, 14, or 15 hd	$11\frac{1}{2}$ by $11\frac{1}{2}$	No ornament but a ticket.
York stripes .	14 or 30	Roll'd & paper'd	Tied with slips of paper.
Jeans & jeannets	30 yards	Ditto ditto	No ornament.
Dimities . .	30	Ditto ditto	Ditto.
Prince's cord	30	Rolled	Doubled, and ornamented with a gold stamp.
Granderills .	14 or 30 yards	Ditto	No ornament.
Bontons . .	12 or 14		$\frac{3}{4}$ checks doubled, and tied in a round fold, with 2 slips red paper, about 2 inches broad.
Listadoes . .	28, 30, or 35	6 by full breadth	$\frac{7}{8}$ checks, cotton or linen, tied with 4 pink slips, 1 with a silver stamp, about $3\frac{1}{2}$ inches broad.
$\frac{3}{4}$ Cotton, or cotton & lin. checks	12, 14, or 20	Tied round	Doubled, and tied with 2 slips, about 2 inches broad.
$\frac{6}{4}$ Ditto . .	20	$16\frac{1}{2}$ by 13	No ornament, only a ticket, with the length.
Kentings . .	6 to 7	9 by $6\frac{1}{2}$	Linens or cottons, with a tuft of silk on each selvage.
Estapillas .	6 to 8	9 by 8	Linens or cottons, with 4 silk tufts on each selvage, and papered with black paper.
Rouens .	45	9 by full breadth	Coarse linens, with stamp of flower de luce.
Crown dowlas	51	Tied round	Coarse linens, with crown stamp.
Anchor dowlas	51	Tied round	Coarse linens, with anchor stamp.
Cassarillas .	20 or 20	Roll'd f. breadth	Coarse linens, with a star.
Platillas .	28, 30, or 35	6 by full breadth	Linens or cottons, with 4 slips, $3\frac{1}{2}$ inches broad, with a silver stamp on one of the slips.
Platillas royales	28, 30, 35	Ditto	A finer kind of ditto, with 4 slips of purple, royal, or black paper,, and a silver stamp.
Britannias .	6 $6\frac{1}{2}$, or 7	15 by 15	Linens or cottons, with 2 tufts, silk or cotton, 1 on each selvage, & a star opposite each tuft.
Russia shirting	36	18 by half breadth	Rolled on a board 15 inches broad, with the Russian arms on the outside.
Russia duck .	36	12 by full ditto	Rolled on a board about 10 inches broad, with the Russian arms on the outside.
Colerains . .	28 to 30	9 by full breadth	Coarse linen, no ornament.
Linen shirting .	25	Rolled double	Generally a gold ornament on the centre.
Pullicates . .	8 handfs.	17 by 17	No ornament, but a ticket.
Ditto .		$11\frac{1}{2}$ by $11\frac{1}{2}$	Ditto ditto.
Madapalams . .	28 yards	12 by full breadth	Stamped on outside with Madapalams, in large letters.
Ginghams, .	36	18 by 12	No ornament but a ticket.
Pullicatures .	12	12 by 9	Ditto ditto, tied with 2 slips.
Caledonias .	12	12 by 9	Ditto ditto.
Creas	20 to 36	45 by 15	Coarse linens, stamped with a dolphin, black, red, blue.

CALIBER, or Calibre, denotes the diameter of any body; and caliber compasses are formed with arched legs for measuring that diameter. They are chiefly in use for ascertaining the diameters of the several parts of a piece of ordnance or of bullets, &c. The caliber rule is an instrument in which a right line is so divided, that the first part being equal to the diameter of an iron or leaden ball of a pound weight, the other parts are to the first as the diameters of balls of two, three, or four pounds are to the diameter of a ball of one pound. This instrument is in use among military engineers for determining, from the weight of the ball given, its diameter, or from its diameter to ascertain its weight.

CALICUT, a district in the province of Malabar, which extends along the sea coast, between the 10° and 12° of north latitude, is inhabited by the Nairs, a remarkable Hindoo sect, and was ceded to the East India company in 1792.

CALICUT, the capital of the district of the same name on the coast of Malabar. The Portuguese, under their celebrated navigator, Vasco de Gama, arrived at this place in 1498, after a voyage of ten months from Lisbon. The town was destroyed in 1789 by Tippoo Sultan, and the inhabitants were removed to Furruckabad; but in little more than a year the province was conquered by the English, and the inhabitants were restored to their old habitations. In 1800, the town had increased to 5,000 houses, and its improvement was rapidly going on. Ginger, turmeric, pepper, teak, and sandal wood, cardamoms and wax, are the chief exports. The distance from Seringapatam is 129 miles.

CALIFORNIA, an extensive region of North America, which lies between the 22 and 40 degrees of north latitude; has for its boundary on the west the Pacific ocean, and is separated from the continent on the east by the gulf of California, the river Colorado, and a mountainous ridge; and includes a superficial area of more than 9000 square leagues. It is divided into New and Old California; the northern division having the denomination of New, and the southern being called Old California. This part of America was discovered by the Spaniards in 1534. The northern part of it, or New California, was visited by Sir Francis Drake in 1577, and it received the name of New Albion from the English circumnavigator.

The southern division of this peninsula is rugged and sterile; a chain of mountains, some of which rise 5000 feet above the level of the sea, and are either destitute of verdure, or covered with low shrubs, traverses the interior. In some of the vallies and the plains near the coast, the soil is fertile, and is well adapted either for tillage or pasture. A great scarcity of water prevails in this part of the country. In an extent of 200 leagues two rivers only flow into the gulf of California, and many of the springs that issue from the ground are soon lost in the dry sand. But the northern division, or New California, is well watered, clothed with woods, and enjoys a fertile soil. Grain of various kinds, and the roots and fruit trees of Spain, beside the fruits of tropical regions, are successfully cultivated in the gardens and fields.

Hares and rabbits are common; a large kind of deer is frequent in the forests; and otters, whose skins have of late years furnished a valuable commercial commodity, are very abundant. Partridges, and a great variety of other land birds, breed in the woods, and numerous sea-fowl are found on the shores. Horses, cattle, sheep, and other domestic animals, have greatly increased. The sea coasts furnish great quantities of fish; and in the southern part of the peninsula, the pearl oyster has been a source of considerable wealth to the Spanish colonists.

The Indian population of this peninsula seems to be on the decrease; but a striking fact is recorded by Humboldt, that the inhabitants of New California, including the Indians attached to the soil, and who had begun to improve it by industry and culture, were more than doubled in twelve years. Fishing, hunting, and agriculture, are the chief occupations of the natives of this country. The original inhabitants, when first discovered by the Spaniards, were in a very savage state. Entirely destitute of clothing, they were attached to many barbarous practices, and were often engaged in war with hostile tribes. Since the establishment of missionaries in 1770 for their conversion, civilization and habits of industry have made considerable progress where the power and influence of the Spaniards reach.

CALIPH, or KHALIF, signifying successor, or vicar, is the appellation of the successors of Mahomet. These caliphs possessing not only sovereign authority, but also the most unbounded influence in their priestly character, were the most absolute monarchs. It was the duty of the caliph, in his function of high priest, to begin the public prayers every Friday in the chief mosque, to conduct the pilgrims to Mecca, in person, to march at the head of the armies, and to grant investiture to princes.

CALIPPIC PERIOD, a series of 76 years which perpetually recurs, and which elapses the middle of the new and full moons, and returns to the same day of the solar year, according to the calculations of Calippus, an Athenian, from whom the name is derived.

CALL is a term among fowlers, denoting the peculiar voice or cry of a bird to its young, or those of its own kind, the knowledge of which is of great importance to those who are employed in bird-catching; for this call being imitated by a bird trained for the purpose, or by an instrument, allures the wild bird to the fowler's net.

CALLA, Ethiopian Wake-robin, a genus of plants belonging to the class Monœcia, and of which Calla Ethiopica, a native of the East Indies, is a common ornament of the green house and parlour.

CALLAO, a sea-port town of Peru, in South America, is one of the most spacious and most secure harbours on the western coast of America. It may be considered as the port of Lima, which is about eight miles distant up a river of the same name. Callao has twice suffered severely from earthquakes, first in 1687, and afterwards in 1746, when, of 4000 inhabitants, not more than 200 escaped that dreadful calamity.

CALLIMACHUS, a Greek poet, who was a native of Cyrene in Lybia, and flourished at Alexandria in Egypt, in the reign of Ptolemy Philadelphus, 280 years before the Christian era. His compositions, consisting of hymns, elegies, and epigrams, are greatly admired for their beauty and classical elegance; and he has been pronounced by Quinctilian, the first elegiac poet of Greece. Beside numerous editions of his works, with notes and annotations by learned critics, an English translation in verse has appeared.

CALMAR, a sea-port town of Sweden, and situated upon the Baltic, opposite to the island of Oeland, from which it is separated by a strait seven miles broad. The population is between 2 and 3000, and the trade in timber, hemp, and alum, is considerable. Some of the inhabitants are occupied in the manufacture of woollen stuffs.

CALMUCKS, are tribes of independent Tartars, who have preserved the Mogul language, manners, dress, and religion, as well as their pastoral and wandering mode of life. At one period they occupied a great extent of the interior of Asia; but the extension of the Russian territories on the one hand, and of the Chinese on the other, has driven them from their original settlements to seek an asylum in distant regions. Many of the tribes have since acknowledged the authority of both these powers, and are engaged by them for military service. The wealth of the Calmucks consists entirely in their flocks and herds, and when the pastures are exhausted in one place they remove to another. They are distinguished by their hospitality, and are strongly attached to their chiefs. The exchange of their horses and cattle for corn, different kinds of cloth, various utensils, and warlike instruments, is their only trade.

CALNE, a town of Wiltshire in England, stands on the banks of the river Marlin, is well built, and, from the remains of edifices and coins that are occasionally found, seems to have been a place occupied by the Romans. The church is a large structure, beside which there are meeting-houses for presbyterians and dissenters. The population in 1811 exceeded 5000; and the inhabitants are employed in the manufacture of woollen stuffs of different fabrics, the machinery for which is driven by the water of the river.

CALTHA, a genus of plants belonging to the Polyandria class, of which one species, *Caltha palustras*, or marsh marygold, only is known, and is a native of this country, forming a fine ornament of the wet grounds where it grows. The flower-buds, it is said, preserved with salt and vinegar, are a good substitute for capers, and the juice of the petals, boiled with alum, gives a yellow colour to paper.

CALVADOS, a department of France, which is formed of part of Normandy, and is bounded on the north by the sea, and on the west by the department of La Manche, on the south by the department of Orne, and on the east by the department of Eure. It includes about 375 square leagues, with a population of 506,000. Grain, hemp, flax, wool, honey, wax, and cyder, are enumerated among the productions of this district. The contiguous sea furnishes plenty of fish of all kinds, and the rocks abound with shell-fish.

CALVIN, JOHN, the celebrated reformer, was born at Noyon in Picardy, in 1509. The early part of his education, conducted privately, being completed, he studied at the college of La Marche in Paris, under Cordery, a teacher of great celebrity; and, having finished a course of philosophy, he was appointed, by the bishop of Noyon, first to a chapel, and to two curacies successively, and in these situations he preached and performed the sacred functions of his ministry. Some change in his views with regard to the doctrines and practices of the church of Rome, supported by the advice and recommendation of his father, led him to form the resolution of directing his studies to another profession. With this intention he commenced the study of law at Orleans; but while he was proceeding in acquiring a knowledge of his new profession, the study of divinity was not neglected. In the farther prosecution of his professional studies, he resided some time at Bourges, where he had also an opportunity of extending and improving his knowledge of the Greek language, under an excellent Greek scholar.

In his 23d year he revisited Paris, and published a Commentary on Seneca's book *De Clementia*, which perhaps merits little notice, excepting from the change of his name from Cauvin to Calvin, which, from causes not well understood or easily explained, seems to have excited great attention, and to have exposed him to much obloquy. By some, indeed, it was regarded as an early proof of his pride, and by his friends it was thought necessary to come forward in his defence.

The freedom of Calvin's opinions, with regard to the new doctrines, began to be publicly known; and, to avoid the persecution which awaited him, he retired from Paris for a short time; but his papers and books were seized, and it appeared from his correspondence, that his own views, as well as those of his friends, were directly hostile to the church of Rome. On his return to Paris in the succeeding year, a conference was appointed between him and Servetus, a Spanish physician settled in France, in whose tragical end, 20 years afterwards, Calvin was deeply implicated; but the physician not choosing to enter the lists with his opponent, failed to appear. Retiring to Basle in Switzerland, Calvin studied the Hebrew language, and first published his *Institutions of the Christian Religion*, various editions of which, in different forms, afterwards appeared. Having made a short visit to Italy, where the reformation had also commenced, he returned to France; but finding his personal safety in danger on account of the opposition which was made to all those who professed the reformed religion, he was proceeding to Basle or Strasburg, by the way of Geneva, where finding the number of protestants rapidly increasing, he was invited to accept of the office of minister of their church, and professor of divinity. In the discharge of his sacred functions he was involved in much controversy, arising partly from the influence of former opinions on those over whom he presided, and partly from his own dogmatical spirit, which refused to yield or accommodate itself to the peculiar views of others. These differences at last broke out into an open rupture, which terminated in the expulsion of Calvin from his official situation. He retired to Strasburg, was appointed pastor of a French church and professor of divinity, and was nominated to attend the diet at Worms, which met in 1541, for settling religious differences.

Solicited by the republic of Geneva, who now began to regret the loss of their pastor, he returned in 1540, and resumed his sacred functions; and during the last 24 years of his life, he was not only assiduously employed in performing the pastoral duties of his office, but in framing political regulations for the government of the republic, and in numerous controversies with those who opposed the Protestant doctrines. His reputation extended far beyond the limits of Switzerland, and attracted students from different parts of Europe to attend his lectures.

But how much is it to be regretted that this great man should have cherished that violent and cruel spirit of intolerance, against which he had such just reason to complain in the church from which he had separated. This intolerance could not escape observation in his intercourse with the people of Geneva; but it exceeded all bounds when he encouraged persecution for conscience sake, and seems to have been the prime mover in the apprehension and condemnation of Servetus, who was brought to the stake on the very day of his trial for his religious opinions; and yet his apologists in the present day, coolly speak of his error being the error of his age, and the reprobation of his conduct as outrageous clamour. It is alleged too, and strongly argued, that the punishment of heretics was positively required by the constitution of Geneva, and that the condemnation and punishment of that unfortunate man were approved by eminent divines. Nothing can be more fallacious than such reasoning; and it is greatly to be feared that those who employ it would not be scrupulous in pursuing the practice which it seems to recommend.

The close of the life of Calvin was marked by severe bodily affliction. He died in May 1564. His irritable and dogmatical temper undoubtedly exposed him to much of that controversy and trouble, which a milder and more conciliating spirit would have escaped; but he was a man of great learning, and the labours which he performed, and the works which he published, afford ample proofs of his indefatigable industry. Beside the works already noticed, one of his most voluminous productions is his Commentary on the Scriptures.

CALUMET, a symbolical instrument in use among the North American Indians, and considered as the emblem of peace. This instrument is about four feet in length, the bowl or head is made of a reddish stone, and the tube is a reed or a piece of light wood hollowed out. It is usually adorned with various figures, and sometimes with hieroglyphical representations; while the ornaments, whatever they be, whether descriptive or fanciful, are said to be peculiar to each tribe. The calumet is presented when warriors of different nations meet; it forms a large share of the ceremonies observed on the arrival and reception of ambassadors; even during the rage of battle, if it be offered and accepted, hostilities cease; and, in the celebrated Indian dance which takes its name from this instrument, one of the two performers engaged in it, is furnished with the pipe of peace. This last entertainment is reserved for great occasions, such as the arrival of strangers or the reception of ambassadors. A resemblance has been traced in the ornaments of the calumet to the caduceus or rod of Mercury among the ancients, which was destined to similar purposes; and hence the remarkable similarity of customs in some things among nations very remote from each other in time and place, has been noticed as a striking circumstance.

CALYCANTHUS, a genus of plants belonging to the Icosandria class, and of which the species *floridus*, or Carolina Allspice is remarkable for its aromatic flavour.

CAMARAN, or KAMARAN, an island of the Red sea, about two miles from the Arabian coast, is about 16 miles in length, and affords good anchorage for large ships, in a bay on the eastern part of the island, from which fresh provisions and good water may be procured. The soil is extremely fertile, and produces sugar, millet, and dates; cattle are reared on the pastures; and the coast furnishes white coral, pearl oysters, and fish, with all which the inhabitants carry on trade with the contiguous continent.

CAMBAY, a city of the province of Guzerat in Hindostan, not far from the gulf of the same name, and on the banks of the river Canari, was formerly one of the most flourishing and most opulent cities of the east, and the sea at one time washed the walls; but vessels of any magnitude can scarcely approach nearer than four leagues. The surrounding territory, from its rich soil, furnished some valuable commodities for trade, as cotton, opium, indigo, and sugar; and the port of Cambay was frequented by ships not only from the different regions of the East Indies, but from the Persian and Arabian gulfs.

CAMBOGE, CAMBOYA, or CAMBODIA, a region of Tonquin in Asia, lying between the 9th and 12th degree of north latitude, and having Cochin-China for its boundary on the east, and the kingdom of Siam on the west. Several mountainous ridges form a kind of natural limits to this country; the river Camboge, or the Japanese river, one of the largest in the territory, derives its origin from these mountains. Corn, rice, sugar, indigo, gums, fine woods, hides, elephant's teeth, are enumerated among the commercial commodities of the country. The inhabitants, who are estimated at one million, are composed of Chinese, Japanese, and Malays. The capital, called also Camboge, stands on the banks of the river of the same name, which is navigable even for vessels of large size to the town.

CAMBRAY, a city of the Netherlands, stands on the banks of the Scheldt, is well built, has some spacious streets, and the episcopal palace, the cathedral, and some other public buildings, are magnificent edifices. It is strongly fortified and defended by a citadel.

The population of Cambray is about 16,000, and it once possessed flourishing manufactures, and enjoyed great commercial prosperity. The manufacture of linen, cambric, lace, tapestry, hosiery, with that of salt and black soap, and extensive bleaching concerns, still occupy the industry of the inhabitants.

CAMBRIA, the ancient name of the principality of Wales.

CAMBRIC, a kind of linen cloth, of a very fine and close fabric. See CLOTH MANUFACTURE.

CAMBRIDGE, the capital of a county, and seat of a university of the same name, in England; derives its name from the river Cam, on the banks of which it is situated, and from the bridge which forms the communication between the two parts of the city; and is supposed to be the *Granta* of the Romans. Numerous utensils and coins, as well as fragments of urns which belong to that people, clearly shew that it was once a Roman station. But the origin of Cambridge is ascribed by some to a much higher period of antiquity. In the present day, it is about a mile long, and about half a mile broad; but the ancient town is supposed to have been considerably greater both in extent and population. The finest street, which

Cambridge.

extends the whole length of the town, is Bridge-street, but the streets in general are not remarkable for their uniformity or the houses for their elegance.

The population of Cambridge which, in 1801, amounted to 10,087 inhabitants, had increased in 1811 to 11,108. Few or scarcely any manufactures have been established. The shops are numerous for the supply of the different colleges; the trade in coals, iron, and corn, by means of the inland navigation, is considerable; a great deal of butter from Norfolk and the isle of Ely is transmitted from Cambridge to the London market; and the trade in wool, hops, leather, and cheese, at two annual fairs in midsummer and September, is extensive, although of late years it has suffered a very great decline. Among the beneficent institutions are, the General Infirmary for the relief of the sick poor, several charity schools, and a number of alms-houses. Some of the churches of Cambridge are remarkable structures; of which the church of St Sepulchre, or the Round church, from its circular form, presents a singular specimen of ancient architecture. It is built in the Saxon style, after the model of the Holy Sepulchre at Jerusalem. Great St Mary's, or the University church, is in the Gothic style, and is furnished with a lofty tower, surmounted by four splendid pinnacles. The members of the university attend divine service in this church, from which the name is derived.

University.—The university, and the buildings connected with its different colleges, constitute the great ornament of Cambridge. A very early period is assigned for the first establishment of schools or places of instruction at Cambridge. Colleges were built and endowed in the time of Edward I. The university now consists of twelve colleges and four halls, which possess very extensive privileges. Every college is a corporate body, regulated by its own statutes, but subject to the controul of the common laws of the university. The chief officers are, the chancellor, who is generally a nobleman, the high-steward, the vice-chancellor, two proctors, beside other officers, for regulating and superintending both the literary and economical affairs of the establishment. The government of the whole university is vested in the senate and these officers; and the senate is composed of all doctors and masters of arts.

St Peter's college, the oldest in the university, was founded in 1257. The chapel belonging to this college is an elegant edifice; and the window over the altarpiece, on which the crucifixion is represented in painted glass, is greatly admired for its beauty.

Clarehall, originally founded in 1326, was entirely rebuilt in 1638, stands on the east bank of the Cam, and is one of the most magnificent structures in the university. The chapel is peculiarly elegant in the style of its decorations, and a splendid alcove over the altar is adorned with a fine painting of the Salutation, by Cipriani.

Pembroke-hall, founded in 1348 by the countess of Pembroke, who, in consequence of her husband being killed at a tilting-match on her wedding-day, determined to retire from the world, and devote her extensive possessions to the establishment and support of beneficent institutions.

Corpus Christi, or *Bene't College*—the latter name being derived from St Benedict, in consequence of its vicinity to the church dedicated to that saint, was finally endowed in 1356. The library of this college possesses a valuable collection of manuscripts, chiefly connected with ecclesiastical affairs, which was presented to it by archbishop Parker, with the peculiar restriction, that if 25 books are at any time missing, and cannot be recovered in six months, the whole devolves on Caius college and Trinity-hall successively, and on the same terms.

Gonvile and Caius college, usually called Key's college, originally founded in 1348, by Edmund Gonvile, was greatly enlarged, and, with a new charter of incorporation, was more richly endowed in 1557, by Dr John Caius, physician to queen Mary.

Trinity-hall was originally endowed about the middle of the 14th century, by William Bateman, bishop of Norwich, and received a splendid benefaction of L.20,000, which was left in 1747 by Dr John Andrews, for the enlargement of the buildings.

King's college derives its name from its royal founder, Henry VI. who, in 1441, established a small seminary, but in a short time enlarged the plan, and contributed more liberally to its endowment. The chapel of this college is greatly admired for the sublimity, elegance, and ingenuity displayed in its design and construction, and is regarded as one of the finest specimens of gothic architecture, while its internal decorations and the exquisite beauty of its painted windows, the subjects of which are taken from scriptural history, correspond with its external magnificence.

Queen's college, founded in 1448, by Margaret of Anjou, consort of Henry VI., was enlarged by the queen of Edward IV.

Catherine-hall was founded in 1475, by Robert Woodlark, chancellor of the university.

Jesus college occupies the site of an ancient benedictine nunnery, which was suppressed by Henry VII. and its possessions granted to John Alcock, bishop of Ely, who in 1497 endowed this college.

Christ's college, originally founded in 1442, was removed from its former situation, and was finally endowed in 1506.

St John's college was originally endowed about the same time as Christ's church; but was not finally completed till 1516.

Magdalene college, which was originally a priory for canons regular, was endowed in 1542, by Lord Audley, chancellor of England. The altar-piece of the chapel of this college is a singular production in stucco.

Trinity college, founded and endowed in 1546 by Henry VIII., is one of the richest institutions in Cambridge. The buildings are remarkable for their magnificence, and the chapel, a gothic structure, erected by Mary and Elizabeth, the daughters and successors of the founder, contains a fine statue of Sir Isaac Newton, executed by Roubilliac. The library of this college is also a magnificent building, which is greatly admired.

Emanuel college was founded in 1584, by Sir Walter Mildmay; and Sidney Sussex college, which was originally a monastery of Grey Friars, was founded by the executors of the countess of Sussex. It has an elegant hall, and its chapel has been lately rebuilt.

Downing college, the most recent establishment in Cambridge, was founded by Sir George Downing; but the will of the founder being disputed, the legal discussions which followed were not finally closed till the year 1800, when the great seal was affixed to the charter of incorporation. This institution consists of a master, a professor of English law, a professor of medicine, and 16 fellows.

The number of fellows belonging to all the colleges exceeds 400, and the number of members exceeds 2000; but it rarely happens that more than 1000 are resident in the university during term. The number of scholarships is nearly 500; besides which, more than 200 inferior officers and servants are maintained on the foundation. The senate-house, in which the public business of the university is transacted, is a splendid edifice, which was erected in 1722. The schools and library compose an extensive pile of building. The botanical garden on the south east quarter of the city covers 5 acres, includes a magnificent green-house of 100 feet in length, besides apartments for lectures on botany, chemistry, and mineralogy, and is furnished with a rich and extensive collection of plants of all kinds.

CAMBRIDGESHIRE, an inland county of England, is bounded on the north and west by Lincoln, Northampton, and Huntingdonshires; and on the south and east by the counties of Bedford, Hertford, and Suffolk; is about 50 miles in length and about 25 miles in breadth, including a superficial area of about 437,000 acres, one-third of which is under tillage, one-third in pasturage, and the other third is still in an uncultivated state. That tract of country which is called the isle of Ely, and consists of fenny ground, intercepted by numerous drains and channels to carry off the water, composes the northern part of the county, and those parts of it which have been drained have been converted into rich meadows or excellent corn land. In some parts of the county the land is pretty high, but produces abundant corn crops, and never rises to a mountainous elevation. The dairy husbandry is successfully practised in some of the districts, and the butter and cheese esteemed for their excellence and rich flavour. Great numbers of sheep are reared on the upland pastures and extensive downs. A good deal of saffron is raised in those parts of the county which border upon Essex. The chief rivers of Cambridgeshire are the Cam and the Ouse. The chief source of the first is in Hertfordshire, and having received various tributary streams, and having passed through Cambridge, falls into the Ouse; the last rises in Northamptonshire, flows through the counties of Buckingham and Bedford, and, having traversed Cambridgeshire and part of Norfolk, discharges its waters into the ocean at Lynn-regis. But beside these natural currents, numerous artificial streams carry off the redundant water from the fenny grounds.

The population of Cambridgeshire was estimated in 1801 at 89,346, and in 1811 had increased to 100,109. Few manufactures have been established in this county. In the neighbourhood of Ely, white bricks, which have been long famous, and a coarse kind of pottery, are made of the clay found on the spot, and give employment to many of the inhabitants. The spinning of yarn for the manufactures of Norwich occupies the industry of another portion; but the pursuits of the great body of the population are chiefly directed to agriculture.

CAMDEN, William, a learned Englishman, was born in London in 1551; was educated at Christ's hospital and St Paul's school, and afterwards studied at Oxford; but being disappointed of a fellowship, he returned to London, and successfully prosecuted his studies. Having afterwards obtained the degree of bachelor of arts at Oxford, he was afterwards appointed second master of Westminster school, and in 1593 was promoted to the head of that seminary. While he was engaged in the laborious duties of the institution, he collected and arranged the materials for his great work, entitled *Britannia, or a Description of Great Britain*. This arduous work, originally composed in Latin, has been several times translated, with large additions; but the best editions are those of Bishop Gibson and Mr Gough. Mr Camden was also the author of a Greek grammar, which appeared in 1597, and was long taught in all the public schools of the kingdom; of an account of the monuments in Westminster abbey; a narrative of the gunpowder plot; and annals of queen Elizabeth. He was also the author of various essays on the antiquities of Britain, and he founded a professorship of history at Oxford. He died in 1624, when he had reached the 73d year of his age. It had been his custom to spend the anniversary of his birth in religious exercises and deeds of charity. In his will he had requested to be buried privately; but he was interred with great funeral pomp in Westminster abbey, opposite to the tomb of the poet Chaucer, and a marble monument was erected to his memory.

CAMEL, a genus of quadrupeds belonging to the order of Pecora. See Mammalia.

Camel, a machine which is employed in Holland for raising ships over the sand banks in the Zuyder sea. This machine, invented, it is said, by the celebrated De Wit, is composed of two parts, the outsides of which are perpendicular, and the insides of a conical form to fit the sides of the ship. Each part is furnished with plugs for admitting the water, and with pumps for discharging it. Being towed out to the vessel which is to be lifted over the bar, they are sunk on each side, and secured with cables; the plugs being introduced during the ebb, for excluding the water when the tide flows, the force of the rising tide buoys up the machine, with the vessel attached to it. Similar machines are employed at Petersburgh to lift vessels over the bar.

CAMELLIA, or Japan Rose, a genus of plants belonging to the Monadelphia class, of which some species and varieties are fine ornaments of the green-house.

CAMELO-PARDALIS, the Camelopard, a species of quadrupeds belonging to the genus Cervus, which is a native of Africa, and remarkable for its great stature. See Mammalia.

CAMEO, is a variety of Calcedony, composed of distinct layers of different colours, and on which sculptures are executed either in high or low relief. The ancients seem to have excelled in works of this kind, and some of their productions are highly prized as the most precious relics. But it is not true, as has been asserted, that the moderns have in vain attempted to imitate these minute sculptures. The reason of the failure is, that they do not receive an adequate reward for their labour. That variety of calcedony called onyx, which is composed of layers of different colours, is employed for this purpose; and if two layers be employed, the one a pure white and the other bluish, the whole of the white layer is removed, and the raised parts of the figure, as, for instance, that of a head, only are retained, and thus the figure, which is pure white, has the appearance of being placed on a blue ground; or the layers being reversed, and the figure being cut in low relief, it will appear a white figure sunk in a blue ground.

CAMERA LUCIDA, an optical instrument, contrived by Dr Hook, for representing the image of an object on a wall in a light room, either by day or night, an account of which appeared in the Philosophical Transactions.

Camera Lucida, is also an optical instrument invented by Dr Wollaston of London, for the purpose of enabling those who are not familiar with drawing to take sketches of objects. *Phil. Mag.* vol. xxvi.

CAMERA OBSCURA, is an optical apparatus by which the images of external objects are distinctly exhibited. See Optics.

CAMERONIANS, a religious sect in Scotland, who derive their name from Richard Cameron, a famous field preacher, who refused to accept the indulgences which were granted by king Charles II. because such acceptance was an acknowledgment of the king's supremacy. Cameron, with some of his adherents, was killed in an engagement with the king's troops at Ayrsmoss, in the county of Ayr. His followers were never entirely reduced till the revolution, when they came under a voluntary submission to king William, and a few of the same sect still exist.

CAMOENS, Luis de, the celebrated epic poet of Portugal, was descended originally from a Spanish family of some rank, and was born at Lisbon in 1517; was educated at the university of Coimbra, and being distinguished by his personal accomplishments, he was favourably received at court; from which, being too deeply involved in its dissipation and intrigues, he was banished. He then retired to his mother's house, and began his famous poem on the discovery of India. But having engaged in military affairs, and displayed great bravery in an action with the Moors, in which he lost an eye, he was recalled to court, and again dismissed on account of the suspicions which his gallantry had excited.

With a resolution never to revisit his native country, he sailed to India in 1553, and on his arrival joined an armament of the king of Cochin, destined to make an attack on a neighbouring state, and in this service his military prowess contributed to the conquest obtained, while his poetical talents celebrated the victory. In the succeeding year he accompanied an expedition to the Red sea; and he visited some of those regions of Africa which he has powerfully delineated in the Lusiad. On his return to Goa, he resumed for some time his epic labours; but a satire on the viceroy was the cause of his banishment to China, where he held an official situation for several years, and was successful in the acquisition of a small fortune. But when he was permitted to return to Goa, he was shipwrecked in the passage, and lost every thing except his poems. Misfortune was still the lot of his eventful life; for a new governor of Goa brought a charge of misconduct against him in his public functions at Macao; he was thrown into prison, and, after a public trial, was fully acquitted. But his creditors detained him in confinement, till their demands were satisfied by a subscription among his countrymen. Having regained his liberty, he appeared again in a military capacity, and accompanied the governor of Sofala to that settlement.

After an absence of sixteen years, he returned to Lisbon; but three years elapsed after his arrival, in consequence of the ravages of the plague in that city, before the Lusiad appeared. It was at last published in 1572. The age in which Camoens lived, or the manners of the poet, which seem to have been little accommodated to the prevailing sentiments and opinions, precluded him from that reward to which the author of so splendid a production was entitled. Misfortune and poverty attended him to the end of his days; and, to the disgrace of his country, he was so destitute of the common necessaries of life, that his servant, a native of Java, was obliged to beg in the streets of Lisbon for the support of his master, or, according to another account, the dying poet was compelled to seek an asylum in an alms-house, where death relieved him from his sufferings in 1579, and in the 62d year of his age.

The merits of the Lusiad have been variously appreciated by different critics. Voltaire has charged the author with great incongruity in the nature and management of the machinery which is introduced in his poem; but he is strenuously defended by Mr Mickle, in whose translation the English reader has an opportunity of examining for himself the beauties and faults of this singular production.

CAMP, the ground which is chosen by an army for pitching their tents, in the selection of which the health, accommodation, and safety of the troops are to be considered. See War.

CAMPAGNA DI ROMA, or Campania, is a province of Italy, which has the Mediterranean for its boundary on the south-west, nearly 50 miles in extent, and stretches about the same distance inland. This district, as its name imports, presents a flat surface, to the south of the Tiber it is undulated, but some of the mountains rise to a considerable elevation, as monte Albano, which is nearly 3000 feet, and mount Soracte, which is more than 2000 feet above the level of the sea. The first is about 20 miles and the last about 25 miles distant from Rome. But monte Mario, in the immediate vicinity of the city, rises 440 feet in the centre of the great plain.

The principal strata of these mountains are of a calcareous nature, and a great deal of volcanic productions is scattered throughout the province.

Among numerous sulphureous springs in this province, the most copious are those which issue from the ground between Tivoli and Rome; the water bursts out nearly at the boiling temperature, and forms the lake of Solfatara. These waters are strongly impregnated with calcareous matter, which being deposited on vegetables and other objects, forms incrustations, collected masses of which compose solid strata, that are dug out and applied to architectural purposes. The famous Pontine marshes, which are noticed in the early periods of Roman History, are in the southern part of the province, and have been partially drained at different times, and converted into tillage and pasture lands.

Various kinds of grain, as well as rice, fruits, and other vegetables, are cultivated in this province. Vineyards and olive plantations are extensive, and afford considerable quantities of wine and oil. Flax and hemp are also enumerated among the cultivated productions of Campagna. A great deal of sulphur is collected; and the manufacture of paper and gunpowder afford employment to the inhabitants. Rome, Frascati, Nettuno, Ostia, and Tivoli, are the chief towns.

CAMPANULA, or Bell-flower, a genus of plants belonging to the Pentandria class. See Botany.

CAMPBELL, John, a writer on history, biography, and politics, was born at Edinburgh in the year 1707. His father was Campbell of Glenlyon in Scotland, and his mother, an English lady, claimed some relationship with the celebrated poet Waller. Of his early education little is recorded, and it does not appear that he had the advantage of academical instruction. In his fifth year he was removed from Scotland to Windsor, probably to live with the relations of his mother. He was afterwards placed as clerk to an attorney; but it is said that he was more disposed to literary pursuits than professional business. His first publication, *The Military History of Prince Eugene and the Duke of Marlborough*, (an elaborate production) established his literary character before he had completed his 30th year; and from this time, to the end of his life, he has found few equals in the extent and variety of works of which he was either the sole author or a considerable contributor. In the latter capacity Mr Campbell had a large share in the compilation of the Ancient and Modern Universal History, the first four vols. of the Biographia Britannica, and the Preceptor published by Dodsley, in which Mr Campbell wrote the introduction to chronology, and the discourse on trade and commerce; and in the former may be mentioned the Lives of the English Admirals and other eminent British Seamen, which is still a popular work, and has been continued by others; a concise History of Spanish America; Voyages and Travels; the Present State of Europe, and particularly the Political Survey of Great Britain.

The works now enumerated furnish ample proof of his devotion to literary pursuits, and of the extent and success of his labours. He was remarkable for his temperate and abstemious habits; and his sedentary life scarcely experienced any other variety than a short occasional walk in his garden. His Sunday evening parties were frequented by many who were eminent in science and literature; and learned foreigners experienced the utmost affability, and the most respectful attention, under his hospitable roof. He had received the degree of Doctor of Laws from the university of Glasgow in 1754; and during the latter part of his life he held the office of agent for the province of Georgia in North America. He died in 1775, in the 67th year of his age.

CAMPBELL, George, a learned theological writer, was born at Aberdeen in Scotland, in Dec. 1719, and was educated at the grammar-school of his native place, where his father was a clergyman, and whose early death left his family in no great affluence. Having passed through a regular course of study of the Latin and Greek languages in Marischal college, and being destined to the profession of a writer to the signet, or attorney, he was for that purpose bound an apprentice. But during his residence in Edinburgh in the prosecution of that object, he had turned his views to the clerical office, and, before his apprenticeship had expired, had attended the lectures on divinity in the university. Returning to his native place, he continued the same studies, and in 1746 was licensed to preach. Two years afterwards he was appointed to a country parish in Aberdeenshire, and having spent nine years in this sequestered situation, he was translated in 1757 to be one of the ministers of Aberdeen; and in 1759 was promoted to the office of principal of Marischal college.

Soon after being placed at the head of this seminary, he preached a sermon on the subject of miracles, as a refutation of Mr Hume's celebrated Essay on that subject; but before it was presented to the world Dr Campbell threw it into the form of a dissertation, and, through his friend Dr Blair of Edinburgh, submitted it to the perusal of the philosopher, who ingenuously acknowledged the ability and learning which it displayed, and the liberal manner with which his positions and arguments were treated. In 1771 Dr Campbell was elected professor of divinity in Marischal college, when he resigned his office as one of the ministers of Aberdeen. But he still continued to preach once every Sunday in one of the established churches. It is scarcely necessary to add, that he discharged the duties of his new situation with great ability and with the highest satisfaction to those who had the benefit of his excellent instructions. In the same year he published a sermon on the Spirit of the Gospel, which is much admired; and in 1776 a greater work, *The Philosophy of Rhetoric*, appeared; and about the same time a sermon on the Duty of Allegiance, in reference to the revolt and independence of the American colonies, in which he maintains that they had no right either from reason or scripture to throw off their allegiance to Great Britain, was presented to the world, and while it received the unqualified approbation of one party, was not less unequivocally censured by another. Every liberal mind will readily admit that Dr Campbell was better employed when he published an *Address* *to the People of Scotland*, for the purpose of suppressing the spirit of intolerance which, in the year 1779, burst forth into acts of tumult and disgraceful outrage against the Roman catholics, in consequence of the relaxation of the penal statutes against that body which was then proposed. About the same time he published a sermon on the *Happy Influence of Religion on Civil Society*. The last work which was presented to the world during his life was his Translation of the Four Gospels with preliminary dissertations and explanatory notes. His *Lectures on Ecclesiastical History*, on *Systematic Theology and Pulpit Eloquence*, and on the *Pastoral Character*, were published after his death, which happened on the 31st March 1796. He had resigned his offices of professor of divinity and principal the preceding year, and had a pension of L.300 a-year conferred upon him by government.

Dr Campbell's character was in all respects highly estimable. As a public teacher, he was greatly admired for the clearness and copiousness with which he illustrated the great doctrines and precepts of religion. His numerous works afford ample testimony of his talents and learning. In domestic life, his manners were kind and affectionate; his conversation was unassuming, agreeable, and instructive; and in his opinions and sentiments, whether of a political or religious nature, he possessed that degree of moderation which commands the esteem and regard of all parties.

CAMPBELLTOWN, a borough town in the district of Kintyre in Argyllshire in Scotland, stands on the east side of the peninsula, and about 12 miles distant from its extremity, which projects towards the north coast of Ireland. The bay or harbour, which is about two miles in length and a mile in breadth, with 6 to 11 fathoms depth of water, is spacious and secure. The town, which is situated at the west angle of the bay, was only a fishing village in the seventeenth century, and was constituted a royal borough at the commencement of the eighteenth. The population, which, about the year 1791, was stated at 5000, exceeded 6000 in 1811. Some attempts have been made to introduce cotton and woollen manufactures; but the capital and industry of the inhabitants are chiefly employed in the herring fishery, which at one period proved a very lucrative concern. The elevated grounds in the vicinity command a most extensive and picturesque view of the frith of Clyde, the islands of Arran, Ailsa, and others rising from its surface, and the opposite shores of Ayrshire and Galloway.

CAMPEACHY, or CAMPECHE, a town of Mexico in South America, stands on the east coast of a bay of the same name, is defended by walls and a strong fort, but has of late years considerably declined. The population is stated at 6000; and the chief trade depends on the exportation of Campeachy wood, or logwood, which is produced in great abundance in the surrounding territory.

CAMPHOR, a concrete substance, which is chiefly obtained from the *laurus camphora*, or camphor tree, a native of the warmer regions of the East, and is also secreted from the juices of other plants, as thyme, rosemary, and ginger. See CHEMISTRY.

CANAAN, was, according to the scripture history, the fourth son of Ham and the grandson of the patriarch Noah, who, for the conduct of his father, pronounced the curse, that he should be a servant of servants to his brethren. This prophetic denunciation, and its final accomplishment, have been the subject of much ingenious speculation among Biblical critics and Oriental writers. According to some, the whole race of Ham was included in the malediction; but, according to others, the descendants of Canaan only were subjected to servitude. The descendants of Canaan, or the Canaanites, were partially enslaved by the Israelites; a greater number was brought under the same humiliating condition in the time of Solomon; and during the invasions of the Assyrians and Persians, who were both descended from Shem, they again suffered degradation and subjection.

CANAAN, LAND of, that country which was inhabited by the posterity of Canaan, and which lies between the Mediterranean and the mountains of Arabia, and stretches from Egypt to Phœnicia. This country was afterwards called Palestine, from the people called Philistines, who inhabited the sea-coasts. It was denominated the Land of Promise, because God had promised to Abraham to give it to his posterity; the land of Israel, because it was occupied by the Israelites; the land of Judea, from the tribe of Judah, being one of the most powerful of the tribes of Israel; and, finally, the Holy Land, because the dispensation of the gospel was first promulgated in it.

CANADA, an extensive province of North America, and one of the most valuable colonies subject to Britain, lies between 64° and 90° of west longitude, including a distance of 1300 miles, and at its greatest breadth between 43° and 49° of north latitude. The gulf of St Lawrence forms the boundary on the east; New York, New England, New Brunswick, and Nova Scotia, on the south and south-east; and the Indian territories on the north-west and south-west. It is divided into Upper and Lower Canada; the former of which lies on the north side of the lakes, and is chiefly inhabited by English colonists; and the latter stretches along the river St Lawrence towards the east, and is occupied in a great measure by French settlers.

The surface of this extensive region exhibits some of the most magnificent scenery on the face of the globe,—in lofty mountains, immeasurable forests, immense lakes or inland seas, huge rivers, and stupendous cataracts. Primitive rocks compose the prevailing strata of some of the more elevated districts, and a large proportion of limestone is distributed throughout the province. Granite forms a vast chain along the north side of the great lakes, while they are bounded by calcareous rocks towards the south and west. Some indications of lead ore have been observed, as well as some iron and copper ores.

The lakes of Canada constitute one of the most striking features in the aspect of the country. Lake Ontario, which is about 160 miles in length, and about 450 in circumference, has a depth of water of more than 350 fathoms, and is studded with numerous islands. Lake Erie is 300 miles long, 40 miles at its greatest breadth, and more than 700 miles in circumference; but the depth, it is said, does not exceed 50 fathoms. Lake Huron is of a triangular form, about 250 miles in length, and more than 1000 miles in circumference. This lake is greatly subject to severe tempests, which render its navigation highly dangerous. Lake Michigan is about 280 miles long, 70 miles at its greatest breadth, and nearly 1000 miles in circumference. This lake lies within the American territories; but it communicates by a strait with lake Huron. The lakes now noticed are far exceeded by lake Superior, which is indeed the largest expanse of fresh water on the face of the globe; the length is about 400 miles, its greatest breadth is about 100 miles, and the circumference is nearly 1600 miles. The depth is in many places beyond the reach of soundings; many islands rise from its surface, one of which is 100miles in length and 40 miles in breadth, and between 35 and 40 rivers, some of which are large streams, discharge their waters into this lake. Beside the lakes now mentioned, many others to the westward and northward, occupy a great extent of the surface of Canada.

The rivers are on the same magnificent scale. Of these rivers the St Lawrence is the most conspicuous, and indeed one of the largest streams on the surface of the earth; from its outlet in lake Ontario till it mixes its waters with the ocean, it runs a majestic course of 700 miles. With the astonishing breadth of 90 miles where it joins the Atlantic, it is navigable for the largest ships, 400 miles from its mouth, and for vessels of considerable magnitude as high as Montreal. The waters of the St Lawrence are swelled with numerous tributary streams, of which the Saguenay is an impetuous torrent, three miles in breadth and 150 miles in the length of its course from lake St John; and beside which, the Montmorency, the Chaudiere, and others, would be accounted large when compared with European rivers. The cascades form another remarkable feature in these rivers. The falls of Montmorency where it joins the St Lawrence are more than 240 feet in height; but with less elevation, they are exceeded in the mass of water by the famous cataract of Niagara, between lakes Erie and Ontario, which is 600 yards in breadth, and divided by two islands into three distinct falls, one of which is 160 feet, and another is 140 feet high. The noise is heard at the distance of 15 miles, and the cloud of vapour is seen at that of 90 miles. Volney, who visited and described this stupendous cataract, has some curious speculations on the probability of the rocky bed of the fall, which is limestone, being worn down by the force of the current, and the huge body of waters above inundating the low country. *Views of the United States.*

The domestic animals are similar to those of Europe. The horse is active and hardy; but it must be a fabulous story, fit only to amuse the credulous, that when he travels over the ice, and happens to sink in the weak parts of it, the driver of the sledge strangles the animal, by pulling a rope which is previously thrown around his neck, and having dragged him on the solid ice, has nothing more to do than to unloose the rope, or to bleed the horse, when he springs on his feet, and proceeds with his former vigour on his journey. The dog having some resemblance to the wolf, is an useful animal in this country. He is employed in the chace by the Indians, and is yoked in the sledge by the colonists.

Numerous wild quadrupeds find an asylum in the immense forests of Canada, and many are taken annually for the sake of the fur, which constitutes a valuable commodity in the trade of the province. The bear, the fox, the martin, the otter, and particularly the beaver, with some of the deer tribes, are the chief objects of this commerce. Birds of the largest size and of the most beautiful plumage frequent the woods; fishes of the richest flavour abound in the lakes and rivers; insects, some of which are exceedingly troublesome to the settlers, breed in myriads near the marshes and river banks; and reptiles, particularly the rattle-snake, in Upper Canada, are common.

When this province came into the possession of Britain in 1760 the population was estimated at 75,000; but at that time Upper Canada, which now contains 100,000 inhabitants, chiefly British or American settlers, was not then inhabited by Europeans. The population of the lower province is now stated at 200,000, nine-tenths of whom are supposed to be the descendents of French settlers, and still profess the Roman catholic religion, and are governed by the old French laws.

The chief towns of the lower province are, Quebec, which is the seat of government, and is situated on a high point of land, on the north-west side of the St Lawrence, is strongly fortified both by nature and art, and contains about 15,000 inhabitants; Montreal, which is 180 miles above Quebec, stands on the east side of an island formed by the St Lawrence and the river Outawas, and includes about 6000 inhabitants; Trois Rivieres, which is about half-way between Quebec and Montreal, and contains about 250 houses, and several other large and populous villages. The towns or settlements of the upper province are, Kingston, near the outlet of the St Lawrence from lake Ontario; Yorktown, which is the seat of government for Upper Canada; Niagara, or Newark, at the west opening of lake Ontario; and Queenstown, about eight miles beyond Niagara.

In the climate of Canada the transitions from cold to heat, and from heat to cold, are very remarkable, and dividing by these sudden extremes the year into two seasons, summer and winter. The melting of the snows is immediately succeeded by the heat of summer, and the season of vegetation is only checked by the sudden approach of winter. In summer the thermometer rises to 92° Fahrenheit, and in winter it sinks sometimes as low as 40° degrees below Zero, and the average temperature in December and January, is 22° below the freezing point. Upper Canada enjoys a milder climate; the winter is of shorter duration, the frost is not severe, and sometimes without any fall of snow.

The soil of Lower Canada is of a light, dark loam, of considerable depth, and very fertile; but in Upper Canada the country is more level, has a richer soil, and is better adapted for cultivation. In consequence of the original system of division and settlement of the lands, the farms are of small extent, and the improvements of agriculture have not made great progress. Barley, oats, wheat, and Indian corn are produced in abundance for home consumption, besides affording a superabundance for exportation, particularly of wheat and flour.

The manufactures of Canada are not very extensive. Some iron forges have been established; ship building gives employment to a great number of the inhabitants; sugar is prepared from the juice of the maple tree; tanning is prosecuted in some places on a pretty extensive scale. A large distillery has been established at Quebec, and several breweries furnish ale, not only for home consumption but for exportation.

The commerce of Canada is very valuable. The principal exports are grain, beef, pork, and fish; various kinds of wood, pot and pearl ashes, flax-seed, and the most valuable of all the commodities, furs. Among the imports, are enumerated wines, spirits, sugar, salt, and coffee. For the collection of furs, numerous settlements have been established far in the interior.

The original Indian inhabitants still form a considerable part of the population of Canada, although they have declined greatly in numbers in consequence of the frequent wars between different tribes, and particularly in consequence of the ravages of the small pox, by which whole families and tribes have been swept away. Another cause of the decrease in the numbers of the Indian tribes is, their immoderate indulgence in spiritous liquors.

Canada was discovered in 1495, by John Cabot, who sailed under a commission from Henry VII. of England, but no settlement was made. The French visited the coast about the beginning of the 16th century, and in 1534 took formal possession of the country. After various unsuccessful expeditions, a French naval officer, called Champlain, explored the river St Lawrence, discovered the lake which is distinguished by his name, and, about the beginning of the 17th century, built the city of Quebec. The new colony experienced various changes of fortune, arising from the feuds and dissensions of the native tribes in which it was implicated, or from the injudicious measures of its European governors. Canada, after the brilliant exploits of general Wolfe at the siege of Quebec, and the success of the British arms in other quarters, was finally ceded to Great Britain by the treaty of peace which was concluded in 1763. See Volney's *Travels*, M'Kenzie's *Travels*, and Heriot's *Travels in Canada*.

CANAL, an artificial cut filled with water, by which a navigable communication is formed between different places. See NAVIGATION, INLAND.

CANANORE, a principality and town on the coast of Malabar, where the Portuguese formed a settlement and built a fort in the beginning of the 17th century. It came under the power of the Dutch towards the end of the same century, and soon rose to great commercial prosperity. In the year 1770 it was assigned to its native sovereigns by the Dutch, was afterwards seized by Tippoo Saib, and came into the possession of Britain in 1790. The sovereign, who is a female, pays an annual tribute to the East India Company.

The town of Cananore is situated at the bottom of a small bay, and contains a number of good houses belonging to Mahometan merchants. The territories of this district do not extend more than two miles, presenting a surface of low hills and narrow vallies, with some excellent rice grounds, which are well drained and supplied with water. Pepper, cardamoms, sandal wood, and sharks fins, are exported to Arabia, Bengal, Sumatra, and Surat; and are exchanged for horses, almonds, piece goods, sugar, silk, opium, benzoin, and camphor. Cananore is 15 miles north-west from Tellicherry.

CANARA, a province of Hindostan, which stretches along the Malabar coast, between the 12° and 15° of north latitude, and is from 40 to 80 miles in breadth; has the Mahratta territory on the north, the Mysore territory on the east, the Malabar districts to the south, and the sea on the west. This district, which was in a state of great improvement, and was filled with industrious inhabitants, was subdued by Hyder in 1763, and was transferred to the British in 1799, and has since enjoyed undisturbed tranquillity. Much minute labour and attention are bestowed in the cultivation of the soil, and abundant crops of rice are produced, not only sufficient for the consumption of the inhabitants, but for exportation. Mangalore is the chief trading port, from which pepper, rice, sandal-wood, oil, betel-nut, and iron, are exported to Arabia, and rice, honey, grain, and tobacco to Goa and the Mahratta countries.

This province is divided into two districts, denominated from their position, north and south. The productions of the northern district are, sandal-wood, sugar canes, teak-wood, wild cinnamon, and pepper. The sea coast is chiefly inhabited by the brahmins, who live in villages; and Battecola, Ancola, and Carwar, are the principal towns.

South Canara which lies between the 12° and 14° of north latitude, affords similar productions to the northern division. Some of the hills are covered with thick forests, among which the teak tree abounds; and the inhabitants along the sea coast are chiefly Mahometans. Mangalore and Callianpoor are the principal towns. The population of this district exceeds 396,000, and the population of the northern district is more than 200,000.

CANARY ISLES, a cluster of islands, thirteen in number, situate in the Atlantic ocean, off the north-west coast of Africa, between 27° and 30° north latitude, and 13° and 18° west longitude from Greenwich. Their general character is that of fertility, agreeableness, and salubrity, and their peculiar position offers important advantages of a maritime and commercial nature. They form, therefore, a valuable appendage to the kingdom of Spain, but are far from being cultivated and managed with a zeal and judgment proportioned to their various excellencies. The appearance of these islands seems to indicate their volcanic origin; and it is certain that their common mineralogical structure, the remains of several craters, and the abundance of pumice-stone and other igneous products scattered over their surface, are not unfavourable to such an opinion. To these circumstances it is not improper to add the peculiar richness of the soil, as a con-

Canary isles firmation of their volcanic nature. The climate, though on the whole both healthy and pleasant, is by no means either uniform throughout their extent, or steady at any one place. Towards the coast, a dry and rather sultry air is apt to prevail; whilst inland, and in the more elevated regions, fogs and rainy weather are very frequent. The wet season, or winter, extends from December to March, but frosts are rare, and snow is scarcely known during this period; and, on the other hand, during the summer months, especially from July to September inclusive, the heat is often very intense, and the sky is generally unclouded.

The chief products of the Canaries are, grain, fruits, honey, and wax. Sugar was formerly cultivated to a great extent, but has for some time been neglected; and they are understood to be highly favourable to the growth of cotton and tobacco. They abound in cattle, poultry, and game, and their coasts are plentifully supplied with excellent fish. Their principal export is wine, of which Britain and her colonies are the greatest purchasers. It is of different kinds, but on the whole bears a considerable affinity to that of the adjoining island of Madeira. The population of the Canaries amounts to about 180,000, distributed throughout seven of the islands, the others being uninhabited. They are chiefly of Spanish origin, few if any of the ancient proprietors, named Guanches, remaining as a distinct race, and the Castilian tongue is universally spoken. Besides their commerce with foreign countries and with one another, the inhabitants of the Canaries have several manufactories established among them, as of coarse woollen cloths, linens, silks, gauze, &c.

The seven inhabited islands, which alone merit any particular notice, are Lancerota, Fuerta-Ventura, Canary, properly so called, Teneriffe, Palma, Gomera, and Ferro, or Hiero.

Lancerota is about 26 miles long and 16 broad, of an irregular shape, divided by a range of hills of considerable elevation, which yield excellent pasture, and are interspersed with vallies not very remarkable for fertility. It has several pretty good harbours, and a few towns of no great importance. Its chief products are grain, cattle, and poultry.

Fuerta-Ventura, to the south of the preceding is the largest of the Canary isles, being more than 60 miles long and nearly 20 broad. It is mountainous at its north and south extremities, but presents several beautiful and rich vallies towards the central parts, which are well watered and plentifully studded with woods. The produce of this island is similar to that of Lancerota. It has several anchoring places, but no harbour of much value.

Canary, or *Grand Canary*, which gives name to the whole cluster, is upwards of 30 miles in circumference, and lies to the south-west of Fuerta-Ventura. It is high in the centre, and slopes towards the coast, where there are many plains of considerable extent. It is plentifully supplied with water, and though its soil is light, is extremely fertile, notwithstanding the indifferent cultivation to which it is submitted. In fruits, flowers, roots, and grain, it may vie with almost any spot of equal dimensions in the world. Its capital, the city of Palmas, is the residence of the sovereign power of the Canaries. The buildings in general are elegant, and some of the public edifices have a superb appearance. It is a place of considerable trade, but in this respect is inferior to the capital of the island next to be named.

Canary isles

Teneriffe, a good way to the west of Canary, is nearly of the same size as Fuerta-Ventura. A great part of it is rocky and barren, and near the centre stands the celebrated peak, whose summit, on which there is a volcanic crater, is upwards of 15,000 feet above the level of the sea. This islands forms the common mart for the Canaries, which accounts for its large population, perhaps amounting to 100,000 souls. Santa Cruz, its capital, is a well-built town, possessing a good harbour, and is tolerably well defended by forts and batteries. Teneriffe is peculiarly productive in wine, good seasons yielding from 30,000 to 40,000 pipes, a third of which is Malmsey or Canary sack, a fine rich wine, and the remainder is of a harder nature, not worth more than half the price.

Palma, lying somewhat to the north-west of Teneriffe, is of an oval form, about 24 miles long and 18 broad. In structure it resembles the island now named, and, like it, presents manifest indications of volcanoes. Its chief town is small, but it has a great number of villages.

Gomera, to the south-west of Teneriffe, is smaller than Palma, and likewise of an oval form. It is mountainous but very fertile, and possesses a tolerable good harbour on the south coast, where its chief town is built.

Ferro, which lies still farther to the west, is only about 16 miles long and eight or nine broad. A large portion of it is craggy and rugged, but it has several fruitful spots. It contains only one town and a few villages.

The Canary isles, though known to some of the ancients, who denominated them *Insulæ Beatæ*, or *Fortunate Islands*, were not visited by the moderns till about the middle of the 14th century. At this period the natives, who are imagined to have been descendants of Lybians, driven from their own country on the conquest of the Arabs, were established in separate states, under different princes, and though far from being very refined in their manners, had attained to no inconsiderable degree of civilisation. They were partly idolaters and partly theists, but were universally under the influence of several erroneous opinions as to religion, and much addicted to superstitious observances and ceremonies. Agriculture was little practised among them, but they paid great attention to their flocks and herds, which constituted their chief riches. Like the Indian tribes, they frequently warred with each other, and had acquired great dexterity in the use of certain destructive weapons, as spears, darts, and slings. But though fierce and vindictive, they were noted for fidelity, and a generous regard to some of the common laws and claims of humanity. The intercourse between the sexes appears to have been under very commendable restraints among them, and polygamy was reckoned illegal; but it is singular that they paid little regard to nearness of blood in their marriages, and that they made no scruple of frequently changing their wives on very slight grounds of offence. They had some notion of the practice of medicine, and had made a little progress in a few of the most useful arts. Nor were the important subjects of legislation and criminal jurisprudence entirely unknown in their societies. These and other circumstances appear decisive, either of their comparatively ancient establishment, or their recent secession from an organised but semi-barbarous community. The latter is obviously the more probable opinion, and receives no slight confirmation from the alleged affinity of their language to that of some of the dialects in the African continent.

The French were among the first of the moderns to visit these islands; but soon after the death of John de Betancour, who obtained a grant of them from Henry III. king of Castile, and who prosecuted a scheme for their conquest with no small success, about the beginning of the 15th century, they were annexed to the crown of Spain. Many years, and much blood and treasure, were consumed in subjecting the people to a foreign yoke, and bringing them to the profession of a new religion. Lancerota and Fuerta Ventura appear to have been more easily acquired; Canary long and earnestly contended for its independency; Palma made a short resistance, and was partly gained by fraud; but Teneriffe gave the greatest trouble, and occasioned most loss to the invaders. The reduction of the latter, in the end of the 15th century, by the force under the command of captain Alonzo de Lugo, a brave but unprincipled man, decided the fate of the whole cluster; and since that period they have remained in entire subjection to Spanish power. Nothing but judicious policy and a liberal government are wanting to render them among the most enviable colonies of which any European kingdom can boast.

CANDAHAR, a province of Afghanistan, lies between the 31. and 34. degree of north latitude, and is bounded on the north by the province of Balk in Little Tartary, and on the east and south by Baloochistan. Excepting in the immediate neighbourhood of inhabited places, this province presents the appearance of a desert. The houses are constructed of bricks dried in the sun; and wheat, rice, dates, almonds, and saffron, are enumerated among its productions. The cold is severe during the winter, while the heats of summer are oppressive. The face of the country is rocky and mountainous; fresh water is scarce in many places, but some of the vallies are fertile and luxuriant. The camel and the dog are the principal domestic animals; and among the wild quadrupeds are found tigers, buffaloes, deer, and antelopes. Some parts of the province furnish diamonds. Many of the natives still lead a pastoral and migratory life. This province has been generally considered as part of the Persian empire, but was long subject to the sovereigns of Delhi, till they were deprived of it by Nadir Shah, and it is now subject to the chiefs of Afghan.

CANDAHAR, the capital of the province of the same name, is a fortified town, and is situated in north latitude 33°. The modern city is of a square form, and is included within fortifications of three miles in circumference; and from its position on the great road which connects Hindostan with Persia and Tartary, possesses peculiar commercial advantages. It is abundantly and cheaply supplied with provisions. An extensive plain in the neighbourhood is covered with well cultivated gardens, which furnish excellent fruits, of which the grapes and melons are said to be equal to those of Europe. The distance of Candahar from Delhi is 167 miles, and from Calcutta 2047 miles.

CANDIA, an island of the Mediterranean, lying between the 23° and 26° of east longitude, and about 60 leagues in length from east to west, and 15 leagues at its greatest breadth. The coast is indented with numerous bays, and many of the harbours afford safe anchorage. An elevated ridge called the White mountains, traverses the greater part of the island, and for half the year are covered with snow, the melting of which, in the spring, forms impetuous torrents, which are dried up during the summer. The climate of Candia is celebrated for its salubrity, and the soil is remarkable for its fertility. The sides of the mountains are clothed with extensive forests of pine-trees, and the vine, the olive, and orange, trees, with a great variety of other fruits and aromatic plants, are enumerated among its spontaneous productions. Wheat, barley, lupines, and flax, are mentioned among the cultivated crops; but however suitable the soil and climate, they are neither extensive nor managed with skill.

The population of Candia has been estimated at more than 350,000, composed of four different races of inhabitants,—the descendants of the ancient Cretans, who inhabit the mountainous districts, and still preserve much of their language, and many of their customs,—the Abadiots, the remains of the Saracens, who were masters of the island more than a century, and who still occupy separate villages, and speak the Arabic language,—and Turks and Greeks, who constitute the largest proportion of the inhabitants. The principal manufactures are, soap, of which a considerable quantity is made at the different towns, and a few silk and cotton stuffs. The situation of this island is peculiarly favourable for commercial enterprize; but the Turks, its present rulers, are little disposed to promote or encourage trade. Oil is one of the chief commodities of exportation; to which may be added wine, honey, wax, raisins, almonds, walnuts, chesnuts, lintseed, liquorice-root, and cheese.

The chief towns of Candia are, Candia, the capital, Canea, and Retimo. *Candia*, the capital of the island, stands on a fine plain, which is supposed by some to have been the site of the ancient *Heraclea*, is about four miles in circumference, and strongly fortified. The streets and squares are regular and well built. The harbour, which was once secure and commodious, has been neglected and is choaked up with mud, from which the trade of the place has declined. The population is about 14,000.

Canea lies on the north side of the island, at the extremity of a spacious bay, and is supposed to be the ancient *Cydonia*, is strongly fortified, the streets are wide and regular, and the squares are adorned with fountains. Canea is the most flourishing seaport of Candia. The harbour has been neglected, and the extensive arsenals erected by the Venetians

Candia. for the accommodation of trade, are in a ruinous condition. The population is about 15,000.

Retimo is also a sea-port town about 40 miles west from Candia, was at one time a place of considerable strength, but the fortifications have been allowed to go to decay; the harbour has been also neglected, and, where large vessels were formerly admitted, small craft can scarcely approach.

Candia, which was the ancient *Crete*, was reduced to the dominion of the Romans in the 66th year before the Christian era, and continued to acknowledge their authority till the beginning of the 9th century, when the Saracens invaded the island, and finally became its masters. In the beginning of the 10th century, it was again recovered and restored to the empire; but about the commencement of the 13th century it was assigned to the Venetians, under whom the agriculture and commerce of the country revived and greatly flourished. Candia was attacked by the Turks about the middle of the 17th century, and after a severe struggle was reduced to their authority, under which it has since continued. The inhabitants of ancient Crete have been estimated at 1,200,000, from which it must appear that the population has greatly diminished.

CANDLE-MAKING.

Introduction. THE word *candle*, which is so well known in the domestic economy of civilized nations of modern times, is derived from the Latin verb which signifies *to burn*, and is supposed not to have been unknown to the ancients, although the lamp was more generally employed for similar purposes. Candles are made of various substances, as tallow, wax, and spermaceti; but the first two substances, and particularly the tallow, are in most general use.

Tallow Candles.—Two methods are followed in making tallow candles, namely, dipping or moulding; but by whatever process they are manufactured, the first step is the preparation of the tallow, on which the quality of the candles greatly depends.

The low temperature at which hogs lard melts, and the offensive smell, and dense black smoke which it emits in burning, have excluded it from the manufacture of candles. The tallow of the sheep and the ox is chiefly employed; and the attention of the mafacturer is first directed to select and sort it for the different kinds of candles. For moulded candles, sheep-tallow, with a certain proportion of the best kind of ox-tallow, is chosen. Candles which are made chiefly from sheep-tallow have a firmer texture and a better gloss. For dipt candles, ox tallow, with those pieces of sheep tallow of an inferior quality, is employed.

The tallow being properly sorted, it is cut into small pieces to prepare it for the first melting, which is called by the workmen *rendering*; and it is scarcely necessary to add, that no time should be lost in completing this process, before the tallow become rancid, or undergo any other change; but after the process of rendering, it may be kept in a moderate temperature for a long time, and be improved. Thus prepared, it is thrown into a boiler, and heat is gradually applied; as the tallow melts new portions are added, and the whole is carefully stirred, and after boiling for some time, a cake, called the *crackling*, forms on the surface. This cake is taken out and subjected to strong pressure, to separate any portion of tallow that adheres to it. The liquid tallow is put into another vessel, through an iron sieve, that any fibrous or solid parts mixed with it may be separated.

Preparation. But a farther purification is still necessary; and for this purpose the tallow is put into another vessel with a portion of water, which having a greater specific gravity occupies the lower part of the vessel, and carries with it such soluble impurities as are mixed with the tallow. After the impurities have settled, the tallow is put into tubs and allowed to become solid, after which the entire mass is taken out and piled up, to be used as occasion requires. In removing the tallow from the large vessel to the tubs, a good deal of precaution is necessary not to disturb the impurities which have collected at the bottom.

From this description of the process of rendering, it must be obvious that two objects are in view; the first is to separate all the fibrous and solid parts from the pure tallow, or oily matter; and the second, when the addition of water is made, is to dissolve and separate those substances which still remain mixed with it, and which could not be extracted by the first part of the operation.

Preparation of the wicks.—The wicks of the better kinds of candles are made of fine spun cotton, and it is generally prepared for the candle-maker in the form of skeins, the number of which is varied according to the proposed thickness of the wick, and being wound off into balls or clues, are cut into proper lengths. The wick is then drawn between the finger and thumb for the purpose of smoothing the threads and removing knots or other matters which might hurt the burning of the candles; but this dressing, as it is called, is sometimes not sufficient to keep the wicks separate from each other when they are arranged on the dipping sticks. This inconvenience may be obviated by dipping a number of wicks in melted tallow, and rubbing them between the palms of the hands, while the tallow which adheres to them cools and becomes solid.

Dipping candles.—Those who are attentive to have candles of the best quality employ a mixture of tallow which has been lately rendered with a certain proportion of some which has been prepared for ten or twelve months, although, in some cases, to save the expence of re-melting, the candles are made immediately after the operation of rendering is completed. The tallow being melted in the one case, or before it has cooled in the other, is carefully skimmed and removed from the boiler with small buckets or ladles into the dipping mould, which is a vessel about three feet long, two feet broad, and

Candle-making.

of the same depth; it is lined with lead, and is raised on a frame at a convenient height for the workman. In cold weather, or when the operation of dipping proceeds slowly, some additional heat is requisite to keep the tallow at the proper temperature; and when this is necessary, it is done by placing a chafing dish below the dipping mould.

The tallow being introduced into the dipping mould, and the workmen having placed a certain number of wicks, which is regulated by the size of the candles, on the sticks or broaches, he takes three of them into his hands, and, while they are kept at an equal distance, he immerses the wicks two or three times in the liquid tallow. The rods are then hung upon a rack to cool; and a similar operation is repeated, till the candles assume the requisite thickness. To abridge the labour of dipping, a long lever is employed in some manufactories. To one end of the lever a wooden frame, on which the broaches with the wicks are arranged, is attached, and the opposite arm is counterbalanced by a weight. That extremity of the lever to which the frame is fixed is immediately above the dipping mould, and the lever is so balanced that the wicks may be immersed in the liquid tallow by a slight pressure of the hand. But this apparatus has been greatly improved by constructing a kind of horizontal wheel, which consists of an upright shaft, with twelve arms placed horizontally and at equal distances. A frame which supports six rods, having each 18 wicks, is suspended from the extremity of each arm. The machine is moved by the workman; and each frame, as it comes successively over the dipping mould, is pressed downwards that the wicks may be immersed in the tallow. With some additions to the apparatus, the facility of dipping is improved, and the steadiness of the machine is secured. The process of cooling goes on during the revolution of the wheel; and the time necessary to finish the candles must depend on the temperature of the air. To ascertain the weight of the candles which are required, it is usual for the workman to take one of the broaches from the frame and hang it on the end of a balance, in the opposite scale of which the weight required is placed.

Moulded candles.—As the name imports, candles of this description are cast in a mould. The mould, which is made of some metallic substance, and generally pewter, is a hollow cylinder, open at the extremities, and well polished within. A small metallic cup is soldered to the top of the mould, and through a hole in the cup the end of the wick is drawn. According to the size of the candle to be made, 12 or 16 moulds are fixed in a frame, the upper surface of which forms a shallow trough. The wicks are introduced with a hooked wire passed through the mould, and when the wick is drawn to the other extremity of the mould it is kept stretched, and in the centre, by means of a cross wire passed through the loop. The liquid tallow is then introduced from a cistern by means of a stop-cock, into the trough, and when the moulds are about half filled each of the wicks is drawn tight, that it may be exactly in the centre of the candle, after which the moulds are completely filled; the frame is then set aside to cool, and when the tallow has acquired a sufficient degree of solidity, the small wires which held the wicks secure are withdrawn, a bodkin is introduced into the loop of each wick, and the candle is drawn out of the mould. The candles are then laid up in the storehouse, and if they are kept for some months they acquire the requisite degree of whiteness; but if they are brought to market soon after being made, it is usual to bleach them by exposure to the open air for several days.

Wax candles are either of a conical or cylindrical form, and they are made with a ladle or the hand. By the first operation, the wicks being prepared, and a dozen of them being suspended by the loops at equal distances round an iron circle, the whole is placed over a tinned copper-bason, full of melted wax. A ladle full of the wax is poured gently on the tops of the wicks, and the operation is continued till the candle acquire the intended size. The three first ladlefuls are poured on the top of the wick; the fourth at the height of three-fourths; the fifth at one-half, and the sixth at one-fourth, when it is required to give the candles a conical form. The candles are then taken down, kept warm, and rolled and smoothed upon a walnut-tree table, with a long square instrument of boxwood, smooth at the bottom.

When wax-candles are made by the hand, the wax is softened by working it in hot water, and it is then gradually applied to the wick hung from a hook. Cylindrical wax-candles are also made either with the ladle or the hand; but they are also made by passing a long wick through melted wax, contained in a brass bason, and at the same time through the holes of an instrument like that used for drawing wire, fastened at one side of the bason.

The importance of candles in domestic economy has led to many attempts to improve their manufacture. In all these attempts, the nature of the material, from its different degree of fusibility, must be taken into account. Tallow melts at 92° Fahrenheit; spermaceti at 133°; bees-wax at 142°; and bleached wax at 155°. The combustion is continued by the melting of a portion of the substance of which the candle is made; and hence the quantity of matter consumed, and the light afforded, will depend on the size of the wick and the fusibility of the matter with which it is supplied. The flame of wax is less brilliant than that of tallow; but as it is less fusible the wick can be made smaller; and this affords the advantage, not only of a clear, perfect flame, but from its flexibility it is disposed to turn on one side, and come in contact with the external air, which completely burns the extremity of the wick to white ashes, and thus performs the office of snuffing. We see, therefore, that the important object to society of rendering tallow-candles equal to those of wax, does not at all depend on the combustibility of the respective materials, but upon a mechanical advantage in the cup, which is afforded by the inferior degree of fusibility in the wax; and that, to obtain this valuable object, one of the following effects must be produced: Either the tallow must be burned in a lamp, to avoid the gradual progression of the flame along the wick; or some means must be devised to enable the candle to snuff itself as the wax-candle does; or, lastly, the tallow itself must be rendered less fusible by some chemical process. The wick of a tallow-candle, then, must be made thicker in proportion to the greater fusibility of the material, which would otherwise melt the sides of the cup and run over in streams. It would be an essential improvement, if some addition could be made to tallow which would render it less fusible, because a smaller wick might be employed and the brilliancy of the flame would be thus increased. For this purpose various substances have been tried, such as resins, gums, and saline matters; but it does not appear that any trials which have been yet made have proved successful; although candles thus prepared, or, as they are called, *chemical candles*, are announced by the manufacturer, not only to be more durable, but to burn with a clearer flame. See Nicholson's *Journal*, vol. i.

CANDY, a large district or kingdom of the island of Ceylon, as well as the capital of that kingdom, which is now under the dominion of Britain. See CEYLON.

CANEA, a sea-port town of the island of Candia. See CANDIA.

CANELLA, a genus of plants belonging to the Dodecandria class.

CANNA, or Indian-reed, a genus of plants belonging to the Monandria class. See BOTANY.

CANNABIS, or Hemp, a genus of plants belonging to the Diœcia class.

CANNÆ, an antient town in Apulia in Italy, of which only some fragments of the walls remain, is memorable in history for the battle which was fought near it between the Romans and Hannibal, the renowned Carthaginian general, when the former were completely overthrown, and the republic itself was threatened with ruin. This famous engagement took place in the 536th year of Rome, and 216 years before the Christian era. The loss of the Romans is stated by one historian at 70,000, and by another at 50,000; while the loss of Hannibal is said to have little exceeded 5000.

CANNIBAL, a name applied to a person who feeds on human flesh. Some authors seem to be exceedingly desirous to establish the fact, that cannibals have existed both in ancient and modern times, and have written long dissertations to prove this point. Under the word ANTHROPOPHAGI, or man-eaters, we have ventured to assert, and from farther consideration we repeat the assertion more strongly, that no race of men ever existed, who, from choice, preferred human flesh to other kinds of food; and that in all cases where such a practice has prevailed, it has arisen from necessity, or has been considered as a religious ceremony. Savages, it is true, very generally devour the bodies of their enemies; but it cannot be doubted that it proceeds from a spirit of revenge, or that it is regarded as a sacrifice to their divinities, or an acceptable service to their warriors who have fallen in battle.

CANNON, a military engine for projecting balls by the explosive force of gunpowder. See GUNNERY.

CANOE, a kind of vessel, or boat, which is employed by uncivilized nations. They are sometimes formed from the trunk of a tree of a light kind of wood, as the cotton-tree of the West Indies, which, from its great diameter, allows them to be made of a large size; sometimes they are composed of different pieces of the bark of certain trees, and sometimes they consist of a frame, which is covered with skins. Of the latter description are the Greenland canoes, which are also covered over or decked as it were with the same material, excepting an opening in the middle, in which the navigator places himself, and drawing the skin tight about his body, renders the whole apparatus air tight. The canoe of the Esquimaux who visited Leith last year (1816,) exhibited a fine example of this construction.

CANON, a person who posseses a prebend or revenue appropriated for the performance of divine service in a collegiate church or cathedral. Canons were originally inferior ecclesiastics, who were regarded as the domestics of the bishop, and who assisted in the service of the church. In the progressive history of the church, the canons became in some measure independent of the bishop, and having other functions beside the common office, they assumed all the rights of the other clergy, and made themselves a necessary council of the bishop, taking upon them the administration of the see during a vacancy, and the right of election of a bishop to supply it. Canons are of various kinds, as cardinal canons, or such as are attached to a church; domiciliary canons were such as, not being in orders, had no right in any particular chapters; expectative canons were such as, without having a revenue or prebend, possess the title and dignities, with a voice in the chapter, and a place in the choir, till such time as a prebend should become vacant. Foreign canons were such as did not officiate in the canonries to which they belonged, and to them are opposed canons residentiary. Regular canons are such as live in community, and who have added the solemn profession of vows to the practice of their rules; they are called regular to distinguish them from secular canons, who decline living in community, as well as the observance of rules for the support of discipline.

CANON, is a law or rule, either of doctrine or discipline, specially enacted by a council, and confirmed by the authority of the sovereign. Canons are, strictly speaking, decisions in religious matters, or regulations of the policy or discipline of a church, drawn up by provincial, national, or general councils. Various collections of the canons of eastern councils have been made. Four of these collections are particularly distinguished in church history. The first was made in the year 380, and consisted of 164 canons; the second, composed in the year 520, received the addition of 50 canons of the apostles and those of the other general councils; to the third were added the canons of the council of Sardica and of the

African councils; and the fourth includes all the canons down to the second council of Nice.

Canon signifies also the authorised catalogue of the sacred writings. See SCRIPTURES.

CANON LAW, a body of law which was promulgated by the see of Rome for the regulation of all matters, whether civil or ecclesiastical, relative to the members of the church subject to its authority. The body of the canon-law, or *Corpus juris canonici*, was revised and published by Pope Gregory XIII. and is composed, first, of a selection called the *Decretum*, of the opinions of the fathers, popes, and church councils, which was made in the 12th century; second, of the *Decretalia*, or rescripts of later popes; thirdly, of another collection of decretals; and fourthly, of a still later collection called *Extravagantes*, because they are in addition to the six books of the decretals.

CANOPUS, an ancient city of Lower Egypt, which stood near the place now occupied by the modern Aboukir. The massy colums of granite, and other splendid fragments which must have belonged to spacious edifices, afford abundant proofs of its ancient magnificence.

CANOSA, the ancient *Canusium*, is a town of Naples in Italy. The ancient city seems to have occupied an extensive plain, in which fragments of columns, aquæducts, amphitheatres, tombs, and baths, and the remains of two triumphal arches, are sufficient proofs of its former grandeur. The modern town is only remarkable for its cathedral, among the internal decorations of which are six fine columns of verde antico.

CANOUGE, or KANOGE, a district in the province of Agra in the East Indies, which extends along the eastern banks of the Ganges, is distinguished by a sandy soil, which is well cultivated, and by the abundance of Mango clumps or groves: to prevent the failure of the crops, when the rains are deficient, the fields are watered from wells by the industry of the inhabitants.

CANOUGE, is a town in the province of Agra, stands about two miles distant from the Ganges, with which it has a communication by means of a canal, and lays claim to great antiquity and celebrity. It was the capital, according to the Hindoo histories, of a powerful empire, which existed at the period of the Mahometan invasion, and, in the exaggerated relations of its extent, is said to have been a hundred miles in circumference. A single street is all that remains of this ancient city; but over a space of six miles, fragments of bricks, and vestiges of buildings, still mark the space which it occupied; and the tombs of two Mahometan saints, which are enclosed in two mausoleums, surrounded with trees, form conspicuous objects on an elevated situation. Canouge is 75 miles from Lucknow, and 719 miles from Calcutta.

CANTAL, a department of France, which has for its boundaries on the north and west the departments of Puy de Dome and Correze and Lot, and on the south and east the departments of Lozere and Upper Loire, is situated in the middle of the mountains of ancient Auvergne, one of which rises about 3000 feet above the level of the sea. The population exceeds 237,000, and a large proportion of the inhabitants is occupied in the dairy husbandry, of which cheese is the most abundant production and the chief commodity of their trade. Marl and slate are dug out in some places, and mines of copper and antimony have been opened. Aurillac is the chief place of this department.

CANTATA, a musical composition, intermixed with recitatives, airs, and different movements, chiefly intended for a single voice, with a thorough bass, though sometimes for other instruments.

CANTERBURY, an ancient city, capital of the county of Kent, and the archi-episcopal see of the primate of all England. See KENT.

CANTHARIDES, Flies which are formed into a plaster for producing blisters on the skin. The species of fly used for this purpose is the *meloe vesicatorius*, a native of Spain, and hence called the Spanish Fly. The specific name, it is obvious, is derived from its effects.

CANTON, a city of China, and capital of the province of Quang-tong, and the sea-port to which the trade with Europe is exclusively confined, stands on the eastern bank of the river Pe-Kiang, from which there is a navigable current for 300 miles into the interior of the kingdom. It is surrounded with walls, which are about five miles in circumference, and are surmounted with a few cannon, but the fortifications are little calculated for a vigorous defence. Canton is in north latitude 23° 7′, which is nearly the same parallel with Calcutta, yet the former enjoys a cooler temperature, and even requires fires during the winter months.

The streets of Canton are very narrow, paved with small round stones, and flagged close to the sides of the houses; but of the space within the walls a large proportion is appropriated to pleasure-grounds and fish-ponds. The suburbs are still more extensive than what is included within the fortifications, the gates of which no European is permitted to enter; and in these suburbs the streets are long and narrow, but regular and paved, kept very clean, and adorned at intervals with a kind of triumphal arches, and sometimes covered with an awning, extending from house to house, to protect the inmates from the rays of the sun. Each side of these streets is entirely occupied by shops, where all kinds of commodities and manufactures are exposed to sale. Some of the streets are solely possessed by particular trades, but in others no restriction is observed. The houses, which are generally built of brick, rarely exceed two stories in height, excepting the mansions of the mandarins and wealthier merchants, which are lofty and elegant. Numerous temples are erected both in the city and suburbs, and the palace of the viceroy is a large building, not destitute of magnificence.

The foreign factories, which extend a considerable way along the banks of the river, form the most beautiful part of Canton. Each is distinguished by the flag of its own nation displayed before it. The British factory is the most conspicuous both for elegance and extent. The whole are arranged on a fine quay, with a broad parade in front, which form a commodious walk for the European merchants, commanders, and officers of ships, who meet after dinner and enjoy the cool of the evening. In the neighbourhood of the factories, warehouses are erected for European goods before they are sold, or for the productions of China.

For the space of four or five miles opposite to Canton the river resembles an extensive floating city, consisting of boats arranged in regular rows, and leaving a passage in the middle for vessels. A whole family is lodged in each boat, which is covered; and, beside this, they have a smaller boat, in which they fish or go on shore to follow their employments. Not fewer than 300,000 individuals, chiefly of the poorer classes of the Chinese, or the descendants of the Tartars, live upon the water, and, indeed, are not permitted to settle on shore. The population of Canton must be very considerable, although no correct estimation of it is known to Europeans.

Provisions and refreshments of all kinds, and of an excellent quality, are abundant at Canton, and are to be had at a moderate price. The numerous canals and rivers, which intersect the country, furnish plenty of fish; large ponds are stocked with gold and silver fish; and in the butcher market are to be seen horse flesh, dogs, cats, foxes, and owls.

The intercourse with China by the way of the Cape of Good Hope commenced in 1517, when a fleet of eight Portuguese ships arrived with an ambassador, who made a visit to Pekin, and succeeded in obtaining permission to establish a trade at Canton. Some English ships visited Canton in 1634; but, through the jealousy of the Portuguese, it is supposed, a misunderstanding took place, which was followed by open hostilities. In 1667, the court of directors requested their agent at Bantam, in Java, to send home 100 lbs. of the best tea. Two years afterwards another quantity was received by the way of Bantam; and in 1678 the importation of 4713 lbs. of tea seemed to have glutted the market, for the imports for the six succeeding years amounted only to 410 lbs. The first ship sent by the East India company direct to China, sailed in 1680; since which period the trade, with some slight interruptions, has progressively increased.

The imports into Canton by the East India company are chiefly woollen stuffs, lead, and tin; the amount of the first, in the year 1809, exceeded L.877,000 sterling, and the total value of all the imports for the same period was more than 1000,000; cotton, opium, piece goods, pearl, saltpetre, sandalwood, shark-fins, and grain, are brought from British India; and the commodities from foreign Europe, and from America, are of a similar nature to those from England, but smaller in quantity. The principal exports from Canton are tea, china-ware, gold in bars, sugar, sugar-candy, rhubarb, snake-root, sarsaparilla, leather, japanned copper, varnished and lacquered ware, drugs, leaf gold, utensils of white and red copper, cast iron, raw and wrought silk, nankeens, mother-of-pearl, gamboge, quicksilver, red lead, vermilion, and toys. In 1809-10, the cost and charges on goods exported from Canton by the East India company, amounted to L.2,378,883 sterling, and sold in England for L.3,723,116. The quantity of tea disposed of at the East India company's sales in 1810, amounted to 24,540,923 lbs. the duty on which was L.3,548,800. The tea shipped on board British ships in 1806-7 amounted to 32,683,066 lbs. and, including what was carried off by American ships and others, the whole quantity exported was nearly 44,000,000 lbs.

CANTON, John, an ingenious experimental philosopher, was a native of Gloucestershire, and was born in 1718, discovered in early life a strong bias to mathematical learning, and having been removed from the school of his native place to be initiated in his father's business, which was that of a broad cloth weaver, he still devoted his leisure hours to physical studies. With no other instrument than a common knife he constructed an upright sun-dial, on which, beside the hour of the day, were shewn the rising of the sun, and his place in the ecliptic. Although this ingenious production was the labour of late hours, which his father had positively prohibited, yet, with his permission, it was put upon the front of his house, where it attracted the notice of some gentlemen of the neighbourhood, and introduced the young philosopher to their acquaintance. Through their kindness he obtained books and a pair of globes, the first he had seen; and with this essential aid he made rapid progress in various departments of natural philosophy.

Among others of scientific attainments, young Canton was fortunate in obtaining the acquaintance and friendship of Dr Miles, a dissenting clergyman at Tooting, through whose recommendation he visited the metropolis, and engaged as assistant to Mr Watkins, the master of an academy in Spital square; when the period of his engagement had expired, he was assumed as a partner in the institution; and, on the death of Mr Watkins, succeeded to the academy, in which he continued during the rest of his life.

About this time electrical investigations, and particularly the nature of the Leyden phial, which was then discovered, greatly occupied the attention of philosophers. Mr Canton made numerous experiments on the subject, particularly with a view of determining the quantity of electricity accumulated in the phial. In 1749 he assisted his friend, Mr Benjamin Robins, in a series of experiments, to ascertain to what height rockets ascended, and at what distance their light may be seen. In 1750 he communicated to the Royal Society a method of making artificial magnets, without the use of natural magnets, and of greater power, a method which had been kept secret by another philosopher. Two years afterwards he repeated Dr Franklin's experiment of drawing electricity from the clouds; and in the succeeding year he communicated to the Royal Society an account of his electrical experiments, in which he remarks, that the clouds were sometimes in a positive, and sometimes in a negative state of electricity. Beside many other experiments on electricity and its kindred phenomena, he made observations on the transit of Venus; discovered a method of making phosphorus, which imbibes and emits light like the Bolognian stone, and which is still known by the name of Canton's phosphorus; and investigated the nature of the luminous appearance of the sea, which he supposes is produced by the putrefaction of its animal substances. He died in 1772, in the 54th year of his age.

CANTYRE, the southern division of Argyllshire in Scotland, stretches about 37 miles from north to south, is about seven miles in breadth, and terminates in the head land or promontory called the Mull of Cantyre.

CAOUTCHOUC, India rubber, or elastic gum, a substance obtained from different trees in South America, and particularly from the *hevea caoutchouc* and *jatropha elastica*. It has been also obtained from some other trees in the East Indies. See CHEMISTRY.

CAP and BUTTON are two small islands which derive their names from their peculiar shape, and which are situated near 6° of south latitude, and 106° of east longitude; are described as presenting, at first sight, the appearance of old castles and ruinous towers, and seem to have been thrown up by the action of volcanoes. These islands were visited by Sir George Staunton; and in the caverns of the rocks were found great numbers of swallows nests, which are in so much request in China. The nests are are placed in horizontal rows at different depths, from 50 to 500 feet. Their value is chiefly determined by the uniform fineness and delicacy of their texture. Such as are white and transparent are most esteemed, and produce their weight in silver in the Chinese market. It is said that the birds are nearly two months in preparing their nests, and when the young birds are fledged, the nests are collected, and this is repeated regularly thrice a year. The inhabitants who are engaged in this business descend into the caverns by means of ladders of bamboo and reeds; but this, like the bird-catching of our own country, is a very hazardous occupation.

CAPE BRETON, an island separated from Nova Scotia by a narrow strait on the east coast of North America. See BRETON.

CAPE OF GOOD HOPE, a colony belonging to Great Britain, on the southern extremity of the continent of Africa, lies between the 17° and 28° of east longitude, and the 29° and 35° of south latitude. The ocean forms its boundary on the south and west, the Great Fish river and Caffre land on the east, and the country of the Bosjesmans on the north. The length, at an average, is stated at 550 miles, the breadth about 230, and it includes a superficial area of more than 130,000 square miles. But a great extent of this surface is covered with naked mountains, or barren plains. Three elevated ridges traverse the country from east to west; the first stretches along the coast, at the distance of from 20 to 50 miles from the sea; the central range, called the Black mountain, runs in a parallel course, and is still higher and more rugged; and the most northerly ridge, rising, it is supposed, to the height of 10,000 feet above the level of the sea, has its loftier peaks covered with snow in the winter season. The elevated ridge which stretches northward from the Cape, terminates in Table mountain, which is more than 3,500 feet above the level of the sea, and two other mountains, which are known by the fantastic names of Devil's-hill and Lion's-head, the first of which exceeds 3300 feet, and the last is about 2160 feet in height. Granite forms the base of all these mountains, and is succeeded by a horizontal stratum of siliceous sandstone, which again is covered by a dark brown sand stone, in which iron ores are disseminated, and the whole is surmounted by a mass of granular quartz, of 1000 feet in height in some places. Parallel ridges of blue compact schistus, but it is not said whether it is micaceous or argillaceous, probably the latter, run from north-west to south-east, and are covered with a body of strong clay, in which are imbedded large blocks of granite. Beautiful agates are found among the decomposed rocks; and *prehnite*, deriving its name from Colonel Prehn, was first discovered at the Cape by that gentleman.

Many of the rivers, which are impetuous torrents in the rainy season, leave their channels dry during the rest of the year. But some of them have a more permanent duration, as Elephants-river, Mountain-river, Broad-river, which is a mile in breadth where it mingles its waters with the ocean, and Great Fish-river, which runs a course of more than 200 miles, and forms the eastern limit of the colony. The coast is indented by numerous bays, of which the chief are, False-bay, Table-bay, and Saldanha-bay, and the last affords good anchorage, and is safe and commodious.

The climate of the Cape is reckoned, on the whole, salubrious; but the sudden changes have a powerful effect on the animal frame. The winds, particularly from the south-east, blow with great violence during certain seasons; thunder storms are frequent; and the rains fall in copious torrents. These winds blast and wither the vegetable kingdom, and are not less baneful in the relaxation of body and mind which they produce on the inhabitants.

A stiff clay, or light sand, is the prevailing soil throughout the colony; and, where it is moistened with water, is invariably covered with luxuriant vegetation. But a great extent of the surface is destitute of springs or rivers; and for great part of the year being rarely visited by a shower of rain, presents nothing but a dreary waste. Such are the plains called *Karroo*, of which the Great Karroo, about 300 miles long and 80 miles broad, has never seen any human being a permanent occupant of its barren sands. But when the rains fall, a vast profusion of vegetation soon appears. These plains are the native seats of many of the succulent plants, and particularly of the curious tribe of *Stapelia*, called, from its remarkable power of resisting the effects of long drought, but with little propriety, the *camel of vegetables*. Between the southern range of mountains and the sea, the soil is deep and fertile, is refreshed by frequent showers, and is covered with luxuriant herbage or lofty woods; in the eastern districts the fertility increases; and the banks of the Great Fish-river presents much variety of rich and beautiful scenery.

Among the wild animals of the Cape, some of the fiercer and larger quadrupeds are conspicuous, as the lion, the leopard, panther, and tiger-cat, the hyena, wolf, and jackal, the zebra, the gnu, many species of antelope, the buffalo, the elephant, the rhinoceros, and the hippopotamus; among the feathered tribes are, the ostrich, flamingo, and spoonbill, with an endless variety of smaller birds, adorned with plumage of the richest and most beautiful colours; and the surrounding seas abound with excellent fish. The botanist need not be informed of the vast profusion of vegetable riches which this territory can boast of, when he recollects how many of the splendid inmates of the stove and conservatory are natives of the Cape. All the rich fruits of tropical climates are abundant. Horses, cattle, sheep, and goats, are the principal domestic animals; and among the sheep is that remarkable variety with broad tails, which are from six to ten pounds weight. It appears somewhat singular, that the number of hogs reared in the colony is very small.

The whole colony is divided into five districts, the total population of which, including Europeans and their descendants, slaves, and Hottentots, or native inhabitants, is estimated at 62,000; but this is exclusive of British settlers. Agriculture is in a very rude state, but wheat, barley, and rye, of which the first is in the largest proportion, are raised in the cultivated districts. The culture of the vine is also an object in many places, and the famous Constantia wine is the produce of two vineyards about eight miles distant from Cape-town. The annual quantity of this wine is from 10,000 to 15,000 gallons. In other districts the rearing of cattle and sheep is the sole occupation of the inhabitants. Many of those who are thus engaged have no settled habitations, but move from place to place as the pasturage for their herds and flocks is exhausted. This class of the population is described as being peculiarly rude in their manners, and severe and cruel towards the Hottentots who are in their service.

While the Cape of Good Hope was under the dominion of the Dutch, its commerce was extremely limited. No trade was permitted with any other but Dutch ships, so that many of the commodities which the inhabitants required were procured by smuggling from such foreigners as touched there for refreshments. Grain, wine, brandy, hides, dried fruits, aloes, and ivory, are the principal exports; but it can scarcely be doubted, as has been suggested, and strongly urged by Mr Barrow, that this colony, from its favourable situation, and the nature of its productions, with proper encouragement and prudent management, holds out the most valuable commercial advantages. Beside the British manufactures, tea, coffee, sugar, spices, rice, and piece goods, are imported from India and China; deal planks, staves, salt fish, pitch, and turpentine from America; iron, timber, French wines, preserves, and pickles, from the northern states of Europe.

For the management of the affairs of the colony, a governor is appointed, as for other foreign settlements, by the king; but its internal police, with regard to civil matters, is regulated chiefly by the laws formerly established by the Dutch; and the constitution of the courts of justice remains nearly the same as in the time of its former possessors. The established form of religion is Calvinistic, and the clergy are paid by government. Different missionary establishments, for the conversion of the natives to Christianity, have been attempted; but after a great expenditure of time and money, none has succeeded excepting the Moravians, who have judiciously commenced their labours by training their followers to habits of industry, and instructing them in useful trades.

The Cape of Good Hope was discovered in 1487, by Bartholomew Diaz, a Portuguese navigator, who, from the tempestuous weather which he experienced, called it the *Stormy Cape*; but, in the prospect of proving a passage to the East Indies, it received its present appellation from the king of Portugal; and ten years afterwards this expectation was fulfilled by another Portuguese navigator, Vasco de Gama, who doubled the Cape, and reached the coast of Malabar. The attempts of the Portuguese to establish a colony failed, and no settlement was made at the Cape till 1650, when a Dutch colony, after treating with the natives, took possession of the peninsula, and founded the present town. The colony received a considerable accession by a number of French refugees, who in 1685 were compelled to quit their own country on account of religious persecution. This colony did not altogether escape the baneful effects of the French revolution. The preposterous sentiments which then prevailed, and the dazzling but false hopes of liberty and equality, had begun to spread among all ranks of the inhabitants, and were about to be put in practice, when the arrival of a British fleet in 1795 turned their attention to other objects. After a slight opposition it surrendered to the British forces, and soon rose to considerable commercial prosperity. It was restored to the Dutch by the peace of Amiens in 1802, but was retaken by the British in 1806, and, by those who have had the best opportunities of appreciating its advantages, is considered a most valuable accession to the colonial territory of Britain, not only as a military, naval, and commercial station, but as the means of securing her Indian possessions against the danger of invasion from the hostile powers of Europe.

Cape-town is the capital of the settlement, stands at the western corner of Table-bay, on a plain with a gentle declivity, and, excepting towards the sea, is surrounded by mountains, is traversed by a considerable stream, and many of the streets, which are spacious and regular, have canals whose banks are adorned with trees; the houses are generally of stone, and two stories in height, and the squares are also spacious and commodious. The castle, to the eastward of the town, is a place of strength, can accommodate 1000 troops with their stores, and includes within its walls the public offices. The barracks, a large edifice, can admit 4000 men; and the courts of justice, the theatre, the guard-house, and the churches belonging to the Calvinists and Lutherans, are the principal public buildings. On the side of Table-mountain stands the government-house and the public garden, of 40 acres extent, part of which is laid out as a botanic garden; and in the same quarter the wealthier merchants have elegant country-houses.

The population is estimated at more than 15,000, of which one-third is composed of whites and persons of colour; the rest are blacks, and a large proportion is in the condition of slaves, either from the east or west coast of Africa, or from the Malay islands. The inhabitants are charged with indolence, and debauchery in smoking and drinking;

it is scarcely to be expected that they should have much ardour in literary pursuits; but it is surprising that they are so phlegmatic as to exclude all relish for public amusements. Exclusive of European and Indian luxuries, living is upon the whole moderate. The necessaries of life, as well as all kinds of vegetables for the table, and excellent fruits, are abundant and cheap. Vaillant's *Travels*, Barrow's *Travels*.

CAPE VERD ISLANDS, a cluster of islands in the Atlantic ocean, about 400 miles west from Cape Verd in Africa, and between the 15° and 18° of north latitude. This groupe, which is composed of ten or twelve islands, some of which are not yet inhabited, was discovered in 1449, by a Genoese in the service of Portugal. Most of the islands are mountainous and rugged, but the vallies are fertile, and the less elevated districts are clothed with rich verdure. Water is not abundant, and rain is not frequent. The fruits of tropical regions are plenty; and rice, Indian corn, grapes, cotton, and indigo, are enumerated among the cultivated productions. Great numbers of goats, hogs, mules, and cattle, are reared, with some of which ships are supplied in their outward bound voyages. The number of inhabitants is estimated at 100,000, the greater proportion of which is composed of negroes and persons of colour. The proportion of whites is said to be very small.

CAPIAS is a law term applied to two kinds of writs, one before and the other after judgment in an action. Before judgment it is called *capias ad respondendum*, where an original is issued out to take the defendant, and make him answer the plaintiff. After judgment it is distinguished into different kinds, as *capias ad satisfaciendum*, which is a writ of execution that issues on a judgment obtained, where any person recovers in a personal action, and is directed to the sheriff to secure the person of the debtor till he make satisfaction. *Capias pro fine* is a writ lying where a person is fined to the king, and is imprisoned till the fine be paid. *Capias utlegatum*, a writ which lies against an outlaw, and directed to the sheriff to apprehend and secure the party till the day of return.

CAPILLARY, derived from the Latin word signifying *hair*, refers to something which is extremely fine, as *capillary* tubes of glass, which are as fine as hair, and *capillary attraction*, which denotes the ascent of fluids in such tubes higher than the surface of the fluid in which they are immersed, a subject which has long occupied the attention of philosophers, and of which no satisfactory solution has been yet proposed.

CAPO D'ISTRIA, a sea port town of Istria, in the gulph of Trieste, and situated on a rock or island, about half a mile distant from the continent, with which it communicates by means of a causeway. It is two miles in circumference, and is the see of a bishop; is adorned with a cathedral, numerous churches and convents; and its chief trade consists of wine and salt. It is eight miles south from Trieste.

CAPPADOCIA, a district or province of ancient Lydia in Asia, seems to have performed a conspicuous part in its struggles with the Persians, the Greeks, and the Romans; became at last dependent on the Roman authority; and in the beginning of the thirteenth century was reduced to the dominion of the Turks, under whose power it still remains, and is distinguished by the modern appellation of Amasia, from a city of the same name which is situated in the province.

CAPPARIS, the CAPER-BUSH, a genus of plants belonging to the Didynamia class, the buds of one species of which, preserved with vinegar, form the well known and agreeable pickle which is annually imported from Italy.

CAPRI, or CAPREÆ an island on the south side of the bay of Naples, about three miles distant from the coast, about eight miles in circumference, and somewhat of a triangular form; exhibits, in the precipitous cliffs, and large masses of rock, a rude and barren aspect; but examined more nearly, spots covered with rich verdure, and studded with houses, are seen. The prevailing strata are limestone. The chief towns or villages are Capri and Anacapri, the former situated on a fertile spot, between two lofty rugged rocks, and the latter, which consists only of a few streets and detached houses, is surrounded with groves of fruit trees, and excellent gardens. Capri is famous for being the luxurious retreat of the Emperor Tiberius, and numerous ruins and fragments of buildings are still visible.

This island is not less remarkable, in modern times, for the prodigious number of quails and stock-doves, particularly the former, which are annually taken, and from which the bishop derives a large proportion of his revenue. In good years, 60,000 quails are sometimes caught; and it is said, that the extraordinary number of 45,000 was taken in a single day.

CAPRICORN, one of the twelve signs of the Zodiac. See ASTRONOMY.

CAPRIFICATION, a method of ripening the fruit of the domestic fig-tree, which is practised in the Levant and Greek islands, by means of the insects which are bred on the wild fig-tree. In the months of May and July, the peasants collect the insects from the wild fig, and place them on the cultivated fig-trees, the fruit of which is wounded by the insects, for the purpose of depositing their eggs, and in this way, the growth of the fruit being interrupted, it comes sooner to maturity; on this the whole process depends. Endless speculations have been indulged by physiologists on this subject; but where the climate is favourable, no advantage can follow such a practice, and hence, as the consequence of more accurate observation, it is said to be discontinued in some of the Greek islands; and in Malta it is followed only for the purpose of bringing the later crops of figs to maturity.

CAPRIMULGUS, the GOAT-SUCKER, a genus of birds. See ORNITHOLOGY.

CAPSICUM, or GUINEA PEPPER, a genus of plants belonging to the Pentandria class.

CAPSULE, in its general meaning, signifies a receptacle or cover, in the form of a bag; and, in botanical language, it is applied to a seed-vessel or pericarpium which divides or splits in a determinate manner. See BOTANY.

CAPTION, in the law of England, is a certificate which relates to commissions to take fines of land, to take answers in Chancery, or depositions of witnesses, and in which the time and place of executing the commission must be declared and subscribed by the commissioners.

Caption, in the law of Scotland, is a writ issued under his Majesty's Signet, and in his name, obtained at the instance of a creditor in a civil debt, commanding messengers at arms and other officers to apprehend and imprison the person of the debtor until the debt be paid. Peers, married women, and pupils, are protected by law against personal execution by caption in civil debts.

CAPUA, a city of the province of Lavora in Naples, stands on the bank of the river Volturno, about twelve miles distant from the sea. The modern town is about two miles distant from the site of ancient Capua. The streets are spacious, and the houses are not destitute of elegance; and, beside the cathedral, it has a number of convents and parish churches. The town is well fortified, and contains about 8000 inhabitants.

CARABUS, the BEETLE, a genus of insects belonging to the order Coleoptera. See ENTOMOLOGY.

CARACALLA, MARCUS AURELIUS ANTONINUS, the Roman emperor, received this appellation from a peculiar garment which he usually wore, flourished about the beginning of the third century of the Christian era, was peculiarly distinguished for his ambition and cruelty in aspiring to supreme power, and of which the first striking example which he exhibited, was the murder of his own brother Geta, in the arms of his mother, and by the hands of assassins, while he himself witnessed the bloody deed, and of his brother's domestics and friends, without distinction of rank, age, or sex; it is said that not fewer than 20,000 were the victims of his barbarous cruelty; but after a short reign of six years, and only in the 29th year of his age, he was assassinated by one of his own officers. See *Gibbon's History*.

CARACCAS, a captain generalship of Spanish America, is situated between the 4° and the 12° of north latitude, and is bounded by the Caribbean sea on the north, by the Atlantic ocean on the east, by Dutch Guiana on the south, and by New Grenada on the west.

General aspect.—Washed on two of its sides by the waves of the Atlantic ocean, traversed throughout its whole extent by highly elevated, and thickly wooded mountains, covered at intervals by expansive lakes studded with islands, intersected in every direction by numberless and noble streams, and dilated in many places into wide savannahs, teeming with vigorous vegetation, this north eastern part of *Terra Firma* presents an appearance not inferior in point either of real magnificence or wild variety to any of the regions of the sublime continent of South America, and is superior to some of them in fertility of soil and salubrity of climate.

Mountains.—A range of lofty mountains, branching off from the main chain of the Andes, in the territory of Quito, extends across the whole of this country to the shores of the Atlantic. This range sends off both to the south and to the north many ramifications, so that the whole district exhibits all the grandeur and picturesque effect of mountain scenery. The mean height of the principal chain is about 8000 feet above the level of the sea, and it extends to the breadth of 50 miles across its summit, in which there are extensive tracts of table land, susceptible of the highest cultivation, and affording abundance of pleasant places for habitations. But some of the points of these mountains ascend to a sublimer height, and, from their rocky steepness and their extreme cold, equally resist the hand of culture, and repel the approach of man.

Rivers.—Multitudes of streams rush with great impetuosity from the mountains, and roll in stately grandeur through the vallies of this highly diversified country; and in their course tend towards either the Caribbean sea on the north, or the great river Oronooko on the south. Of the streams that seek the Caribbean sea are the Guigues, the Tocuyo, navigable 40 leagues from its mouth, the Yaracay, the Tuy, winding through delightful vallies, the Urana, which divides the province of Caraccas from that of Cumana, the Nerveri, and the Mazanari. These and many more of less note which water the northern side of the country, and open a communication with its interior, are confined within high banks, which they seldom overflow. The southern declivity of the principal mountainous range which traverses this country, is also well watered by frequent streams; such as the Apura, the Mamo, the Pariagoan, the Pao, the Zoa, the Chivata, the Cachimao, the Aracy, the Marapira, and the Espino, which, though magnificent rivers, pour their tributary waters into the still more magnificent Oronooko, that in majestic grandeur flows with a rapid career from the Andes through wide savannahs, till, by a multitude of mouths, forming a labyrinth of swampy isles, it falls into the Atlantic.

Lakes.—Of the numerous expanses of stagnate water with which the surface of this country is interspersed, two only, the Maracaybo and the Valencia, have been particularly described. The Maracaybo in form resembles a bottle, with the neck communicating with the sea; it is situated at the western extremity of the country, 150 miles in length, and 90 in breadth. Though open to the sea, its waters, except when agitated by the north wind which blows in the brine, are fresh enough to be drank. The banks are barren, and exhale noxious vapours, destructive of animation when long exposed to its deleterious influence; and at Mena, on the north-eastern border, they blaze nightly with phosphoric fires, which serve to direct the course of those who navigate its waters. Valencia is 40 miles in length and 12 in breadth; and though it receives the waters of twenty rivers, it has no visible outlet. The valley in which this lake is situated, the sloping sides of the hills by which it is surrounded, and, still more, the islands which seem to repose on its bosom, constitute a scene of picturesque beauty, similar, it is said, to that of Loch Lomond in Scotland.

Minerals and metals.—The researches of the scientific and enterprising Humboldt, first unfolded the mineral riches of this region. According to him, the mountains are composed chiefly of calcareous strata, resting on a base of primitive rocks. The salt-pits

Caraccas. of the province of Venezuela, supply great quantities of this mineral, of the most beautiful whiteness. Mineral springs, both hot and cold, are also common. The heat of the springs found in the vallies of Aragua, raises the thermometer nearly to the boiling point. These mineral waters possess medicinal qualities.

The first object of Spain, in colonizing America, was the discovery of gold and silver; and with this view the country of Caraccas was early and anxiously explored by her avaricious adventurers. After much search, the wished-for gold was found; but from the insubordination of the negro slaves, and the hostility of the Indians, the mines never could be worked to any extent. Though, however, the Spaniards have been comparatively unsuccessful in their attempts to obtain the gold and silver deposited in this country, they possess, in the jurisdiction of St Philip, copper mines, from which they obtain copper for the implements required by the planters, and have a surplus for exportation.

Pearls.—The first settlers in this country were consoled, and in a great measure compensated, for the want of the precious metals, by the discovery that its coast contained abundance of valuable pearls. The shoals which extend from Cape Paria to that of Vela, the island of Margaretta, and some other places of the coast, were found to contain them. The pearl fishery in this quarter was long a source of riches and revenue; but for the last century and a half it has been unproductive, few pearls in all that time having been found, and these few of little value. It is now abandoned to the Indians, who sell their pearls to the Dutch or English.

Climate.—The heat to which Caraccas is subject, notwithstanding its exposure to the influence of a tropical sun, is seldom excessive; the high elevation of a great part of its surface, and the fanning effects of the breeze which always blows from the sea, cool the atmosphere to a pleasant temperature. During winter, or rather the rainy season, which extends from May to November, the thermometer sometimes falls to 50°; and in summer, or the dry season, it is seldom seen to rise above 86°, except in some of the most exposed plains, in which the burning heat of the torrid zone is experienced in all its violence. The broad savannahs, through which the Oronooko and its tributary rivers have their course, are inundated during the whole period of the rainy season, and present to the observer one boundless expanse of troubled water. The rest of the year they are pastures clothed with flocks, or vallies covered over with corn.

Vegetation.—The fertile soil of this region, under the constant excitation of heat and moisture, sustains a vigorous and a various vegetation. Like the rest of America, vast tracts of the Caraccas are covered with thick forests, in which are cedar, oak, ebony, and many other sorts of trees of excellent timber, or useful for their medicinal or colorific qualities; coffee, cocoa, cotton, sugar, indigo, tobacco, wheat, maize, and a great variety of fruit-trees, are objects of culture. But the plantations of these valuable crops are under a bad system of management, and more than nine-tenths of the whole surface are left in a state of nature. The backwardness of the agriculture of this fine region is owing, according to Depons, to the number of mortgages with which almost every estate is burdened; the pious legacies with which they are encumbered; the pride of the planters, who disdain to superintend their own affairs; their ambition for public employments; the ignorance and the carelessness of the overseers to whom the charge of the plantations is committed; and the want of labourers, properly and seasonably to prepare the soil, to keep the growing crop clear of vermin and weeds, and to gather in the ripe produce. The use of the plough is unknown, but irrigation is well understood.

Animals.—The quadrupeds and birds of Caraccas are the same in general with those of the Brazils, and other parts of South America. The horses and horned cattle of Europe have become very numerous, and roam uncontrouled over the hills and the vallies of this highly favoured country.

Towns.—This captain-generalship is divided into five subordinate provinces; Maracaybo on the west, Cumana and the island of Margaretta on the east, Guiana on the south, and Venezuela in the centre; over which numerous towns, villages, and hamlets are scattered. Those towns which deserve to be particularly noticed are, St Jago de Leon, or Caraccas, the capital, which stands in 10° 31′ north latitude, eight leagues from the coast, in a beautiful valley 2000 feet above the level of the sea, on account of which it enjoys a perpetual spring. The streets are wide and straight; they intersect each other at right angles, which form the whole into divisions, called *quadras*. The principal square is used as the market place. The cathedral, the college, and the prison, occupy a part of three of its sides. The town contains 40,000 inhabitants.

Guayra,—the port town of Caraccas, is meanly built, at the foot of high mountains, close on the shore.

Maracaybo—is a tolerably built town, on the neck of the lake of the same name, by which it communicates with the interior. It stands 140 miles west from Caraccas, and contains 20,000 inhabitants.

Coro—was once the capital of Venezuela; it stands on a sandy soil, and has long been in a declining state. *St Philip* is well built, and has about 7000 inhabitants. It stands 50 leagues west from Caraccas. *Carora* has 6000 inhabitants. *Tucuyo*, which stands in a narrow valley, has also 6000 inhabitants. *Valencia*, built near the lake of the same name, has 8000 inhabitants. *Barquiscmento* stands in a fertile and beautiful district about 40 leagues south-west of Caraccas, and has 11,000 inhabitants. *La Vittoria* is a straggling town, interspersed with gardens; the officers of the militia of the vallies of Aragoa have their residence in this town. A Plaza is planned, but not completed; it however contains a church of superior architecture. In the vicinity the wheat and sugar cane are seen growing together. The inhabitants are 8000. *Guanara* stands on a river of the same name, 95 leagues from the capital, and contains 10,000 inhabitants. *San Carlos* has 9000. *Porto Cabello* about 8000. El Consejo, Calabosa, St Luis, Caraccas. St John the Baptist, Maracay, Truxillo, and a few other villages, have from four to six thousand inhabitants, of all colours.

Population.—The inhabitants of the whole captaincy are estimated at about 800,000, a fifth of whom are whites, three-tenths slaves, two-thirds free people of colour, and one-tenth Indians. The catholic faith prevails, but priests are on the decline, and no convent has been founded for the last eighty years. The military establishment in the provinces used to amount to 13,000 men. Some of the coast towns are well fortified; but the richest inland towns are left open. Indolence, gambling, and voluptuousness, debase the inhabitants of this region. Their cookery is Spanish; oil and garlic being ingredients in every dish. Poultry is scarce, so that a common fowl costs a dollar; but beef is cheap, and fish is abundant. Pocketing of fruit and sweetmeats is a common custom at the best tables. In a word, the manners are Spanish, by no means purified by being carried across the Atlantic, or mixed with the usages of the Indians.

Commerce.—The commerce of this rich country languished long under impolitic restrictions. The Dutch, after they settled in Curaçoa, first drew the attention of the Spanish colonists to the advantages of industry and trade, by the price which they paid for their commodities. A trifling traffic was soon after carried on with the mother country, and an extensive contraband trade with the more enterprizing Hollanders. In 1728 the merchants of Biscay offered to put an end to this illegal traffic, and to transport the produce of this colony to Spain. Their offer was accepted, and though they accomplished their design with moderation, yet their interference excited deep discontent in the province of Venezuela; for the removal of this dissatisfaction, an assembly, consisting of an equal number of merchants and planters, was established in the year 1750. Under this regulation, imperfect and restrained as it was, the country began to improve. The land was cultivated, towns were built, and riches increased. In 1778 the ports, both of Caraccas and Spain, were declared free, and a scale of duties, payable for the commodities exported, was at the same time established. The European merchandise in demand in Caraccas are linens, laces, and black stuffs both of woollen and silk, broad cloths, French hats, and coarse woollen, linen, and cotton manufactures.

The principal exports are cotton, coffee, cocoa, tobacco, indigo, and hides, all of which are of excellent quality, especially the cocoa, which is superior to that of the other colonies. The most frequented ports are Cumana, well sheltered from the inclemency of the weather; Guayra, little better than an open road, a strong surf breaks on the shore; Porto Cabello, large and safe; Coro, once the centre of the contraband trade; and Maracaybo, a capacious harbour, but rendered almost inaccessible by reason of a bar of sand which obstructs its entrance. Besides these there are many other bays and mouths of rivers which afford good moorings to the vessels employed in the trade of this country

Revenue.—A tax of *five per cent* is collected on all sales of every sort of property; two-ninths of the tithes go to the crown, which, with the duties on imports and exports, form the chief resources for defraying the public expences of the colony.

History.—This part of the continent of South America was discovered by Columbus in the year 1498, who took possession of it for the crown of Spain. Sometime afterward it was subdued by force of arms, and placed by Charles V. under the administration of a company of German merchants, by whom it was long harassed. The complaints which arose in consequence of this abuse of power led to the appointment of a government responsible to the crown for its conduct. The power of the governor of Caraccas, under the appellation of *Captain-general*, was supreme over all its subordinate provinces, both in civil and military affairs; and this system continued according to its original establishment till the year 1811, when the congress of Venezuela, refusing to submit to the usurped authority of Bonaparte, published a formal decree of their independence, and a declaration of their rights. A civil war has been the consequence, in which much blood has been shed; and the contest, it is feared, will cost a great deal more before it is finally decided. Humboldt's *Personal Narrative;* Depon's *Travels;* Semple's *Sketch of Caraccas.*

CARACCI, Ludovico, a celebrated Italian painter, and founder of the school which was distinguished by the name of Caracci's academy, was born at Bologna in the year 1555, and died in 1619. He carefully studied the works of Titian, Paul Veronese, and Corregio; and thus, improving his taste, rose to the first eminence in his profession. Grace, dignity, and sweetness are the characteristic features of his works; and even when he aspired at elegance the efforts of his pencil were successful. He was extremely assiduous, and peculiarly fortunate in directing the studies of the pupils who attended the academy which he established and superintended. His most celebrated painting in oil is the altar-piece of St John the Baptist in the Cortosa of Bologna; a picture which graced the walls of the Louvre among the other plunder of the valuable productions of the Italian school, but is now undoubtedly restored to its rightful possessors.

CARACCI, Augustine, an eminent Italian artist, was cousin-german of Louis Caracci, and was born at Bologna in 1558, and died in 1602. He was chiefly instructed in the principles and practice of painting by his cousin, whom he assisted in the management of the academy. His style of execution is distinguished by correctness and elegance of form, refined taste, and vigorous expression. His most admired painting in oil is the Communion of St Jerome, in Bologna, which shared the fate of the other rich spoils of Italy, being carried off to adorn the French Louvre, but it is hoped has been restored to its own place.

CARACCI, Annibale, a celebrated Italian painter, was the brother of the preceding artist, and was born at Bologna in 1560, and died in 1609. To his cousin Louis he was indebted for his knowledge of the principles of the art. He rose to great eminence in his profession; the efforts of his genius were not confined to one department, for he painted portraits and history, but excelled chiefly in landscapes. His works are distinguished by grandeur of design, liveliness of expression, vigour and firmness of execution. His most splendid undertaking is the Farnese Gallery at Rome, which he was invited to execute by the cardinal of that name, and which required the assiduous labour of ten years; and for which, it ought to be recorded, he received only the scanty remuneration of five hundred crowns.

CARAMANIA, a province of Asiatic Turkey, which extends along that part of the Mediterranean which is opposite to the island of Cyprus, and includes some regions, as Pamphylia, Cilicia, Lycaonia, and others, which were famous in antiquity. The coast is in general lofty; but presents many excellent and capacious harbours. The mountains are covered with thick forests; several lakes are well supplied with fish, and furnish abundance of salt; and a good deal of silk is produced. Satalia, which stands on a gulf of the same name, is the capital of the province.

CARAVAN, derived from a Persian word which signifies a trader or merchant, is a company of merchants or pilgrims who travel through Africa and Arabia, in large bodies, to secure themselves against the attacks of the native tribes, who live chiefly by plunder. By means of these caravans a great trade is carried on in the central parts of Africa. Their departure is fixed at stated periods, and four of them proceed annually to Mecca; the first is from Damascus, and consists of the pilgrims and merchants from Europe and Asia; the second, composed of the Mahometans of Barbary, departs from Cairo; the third assembles near the entrance to the Red sea; and the fourth, which is made up of Persians, sets out from Babylon.

CARAVANSERA, a public building in eastern countries, for the accommodation of the merchants and pilgrims who accompany the caravans. Edifices of this description are of a square form, often of great magnitude, and have one or two stories above the ground-floor. A spacious court occupies the middle of the building, and is surrounded with magazines and piazzas for the reception of merchandise and the camels which carry it; the upper apartments are destined to the accommodation of the merchants and travellers. Some of these caravanseras, which are erected in the towns, are magnificent structures; and some of them are built in desert places, which afford no other kind of accommodation. But in such places the traveller finds nothing but the bare walls; he must carry with him everything else for his own use.

CARBONE, in chemical language, is the element or pure part of charcoal, of which the diamond, which is crystallized carbone, furnishes the best example. See CHEMISTRY.

CARBONATE, a compound of carbonic acid and some base, as with lime, which forms common limestone, or chalk, or marble; or with the oxide of copper, which forms blue or green copper-ore. See CHEMISTRY.

CARBONIC ACID, a compound of carbone and oxygen, which was formerly known by the name of fixed air, or aerial acid; and of which the air, which escapes from brisk small beer, and the air which collects at the bottom of deep pits or wells, and is so noxious to animal life, are examples. See CHEMISTRY.

CARBURET, a compound of carbone with some other substance. Common cast-iron, which is composed of carbone and iron, is a carburet of iron; and the air which is consumed in the well-known gas-lights, is a compound of carbone and hydrogen, and is called carburetted hydrogen. See CHEMISTRY.

CARCASS, a hollow body which contains combustible matters, and is thrown from a mortar for the purpose of annoying the enemy, by setting fire to houses. The carcass is sometimes an iron shell, with a number of openings; and sometimes it is made of ribs of iron covered with pitched cloth. Implements of war of this description, it is said, were first brought into use by the bishop of Munster, and were employed in 1672 at the siege of Croll.

CARCASSONE, the capital of the department of the Aude in France; stands on the banks of the river Aude, which divides the town into the upper and lower town, and partly on the banks of the canal of Languedoc; is surrounded by a wall, and defended by a castle on an elevated spot, which is also occupied by the cathedral. The lower town is of a square form; has regular streets; and a spacious square is adorned with a fountain. The population is about 15,000; and the inhabitants, who are chiefly employed in the manufacture of woollen stuffs, are distinguished for their industry.

CARD-MAKING.

CARDS are well known instruments employed in the preliminary operations which wool and cotton require for being manufactured into cloth. In the extensive manufactures of Great Britain, card-making has become an object of great importance; and in no department of useful art has ingenuity been more successfully exercised, in facilitating and abridging the numerous minute operations which it requires.

The manufacture of cards in Britain probably commenced about the middle of the 15th century. Before that time they were imported from the Netherlands, along with the Flemish weavers, who emigrated to Britain, and greatly improved the woollen manufactures. But in 1463, for the purpose of encouraging the manufacture at home, the importation of cards, and other instruments and utensils of iron, steel, and copper was prohibited.

The first kind of cards, which continued long in use, were called *hand-cards*, because the operation was performed by the hand with a pair of cards. In the progressive improvement of manufactures, and

Cardmaking the introduction of machinery, stock-cards were employed in place of hand-cards, which were farther superseded by the extensive use of cylindrical cards.

The principal card-manufactories in Britain are at Halifax and neighbourhood, in Yorkshire, and at Leith. The oldest establishments of the kind in this country are in Yorkshire; but the first and oldest card-manufactory in Scotland is still continued, at Leith, by Messrs Stead and Paterson; and although it is the most extensive and best conducted manufacture in the northern part of the kingdom, yet it has been passed unnoticed in topographical accounts, and in treatises which are professedly descriptive of card-making. The great-grandfather of Mr Stead, one of the present proprietors, was invited from Yorkshire to Scotland in 1696, and settled at Haddington, for the purpose of manufacturing cards for a woollen manufactory which was established at that place. The establishment, which has now existed in eight generations of the same family, was afterwards removed to its present situation in the vicinity of Leith; and through the liberality of the proprietors we were gratified with a minute inspection of the whole operations connected with the manufacture, and had an opportunity of comparing the instruments which were in use for the different operations 120 years ago, with the elegant and more perfect apparatus which is now employed for the same purposes. This comparison affords a fine example of the resources of art, and of their application to facilitate and accelerate labour. In this manufactory, every part of the work, from the preparation of the wire from the iron bar, to the completion of the card, is performed, and the greater part of the operations is conducted by machinery set in motion by an excellent steam-engine.

In the preparation of the wire for cards, three different operations are required; cutting to proper length; doubling, to give it the form of a staple, as it is called; and, lastly, giving it the knee-bend. To these operations may be added the preparation and pricking of the leather, the insertion of the wires, and the setting and polishing to make them uniform and smooth.

Cutting.—The wires are cut off from a coil consisting of 30 or 40 turns, the separated ends of which are placed in a steel-gauge, which marks the proper length of the teeth. The cutting instrument is a pair of strong shears fixed to the edge of the table at which the work is done, and moved by the pressure of the foot on a lever under the table. When the pressure is removed, the shears open by a spring or counterbalancing weight operating over a pulley. In this way, the number of wires cut at each stroke corresponds with the number of turns in the coil, and this number is greater or smaller according to the size of the wire. When the wires are small, from 30 to 235 are cut off at each stroke of the shears.

Doubling.—The operation of bending the wire into the form of a staple, is called doubling, and this is performed by means of an instrument called the *doubler*, which consists of a steel gauge fixed in the end of a wooden handle. The ends of the wires are placed in a groove, the depth of which is exactly equal to the intended length of one of the legs of the staple. The wires are then bent by the pressure of Cardmaking an instrument called the *bender*, which is somewhat in the form of a small reaping-hook without an edge, over a small flat bar of steel fixed in the doubler, and called the *bridge*; and, by a second pressure, bends the wire over the opposite angle of the bridge, and in this way the second leg of the staple is formed, and of the same length as the first. From 30 to 150 of these staples are made at a single operation when the wire is small; but for thicker wire a more powerful apparatus is required. The doubler is then fixed in a frame, and the bender operates by means of a strong lever. With a small steel knife, the wires are removed from the bridge of the doubler, and are conveyed to a machine by which the operation of bending is performed.

Bending.—The knee-bend which is given to the staples, is executed by a very ingenious machine, said to have been the invention of a quaker about the year 1775. This machine operates by means of wheels like clock-work, and the moving power is a weight which acts over a set of pullies, like the common roasting-jack. The machine is about eight inches long, and an axis, extending its whole length, revolves equally by the action of the apparatus now mentioned. Eight or ten small levers or claws are screwed on the axis at certain distances; the height of these claws or levers, which may be increased or diminished by the screw, is proportioned to the bend of the staple required. Opposite to each lever, and placed at some height above the axis, is a double brass ruler, on which is suspended a number of staples as they are removed from the bridge of the doubler with the knife. This ruler is slightly inclined, and during each revolution of the axis, a single staple is lifted over a knob or projection by means of a small tooth or lever called the *kicker*, which is concealed in the groove of the ruler. The staple runs down another inclined ruler, at the bottom of which is a recess which admits the legs of the staple. In this position, the claw or lever, by the revolution of the axis gives the knee bend to the legs of the staple. After the claw has passed, the staple instantly springs out of the recess by the reaction of the wire, while another staple is brought down to undergo the same operation at next revolution. The number of staples bent at each revolution of the axis in this machine, is equal to the number of levers with which it is furnished; and the advantages of such an apparatus must be obvious, for, from the accuracy of its construction and operation, the whole of the staples are bent at precisely the same angle.

In the early period of the card manufacture, this operation was performed with a very simple machine. It is a small axis, on the circumference of which is inserted a plate of steel, in which two small holes are drilled to receive the legs of the staple. A single staple is inserted by the hand at each revolution of the axis, which is turned by a wench or handle with the other hand. In the revolution of the axis, the staple is brought into contact with a strong spring, in passing which it receives the bend. But as the strength of the spring cannot be uniformly the same, the uniformity of the knee bend cannot always be depended on. A machine which operates on a similar principle is still in use, to give the knee bend to strong wire; a single staple is bent at a time; the machine is set in motion by the pressure of the foot on a lever; and while the staple is inserted with one hand, it is removed from its place after being bent by means of a lever, which is acted on by the other. This work is generally performed by women.

But ingenuity has been exerted in the invention of machines which perform all the different operations of cutting, doubling, and bending successively. A machine of this description is employed at a card manufactory in Yorkshire; and the model of another on a construction somewhat similar, and the invention of Mr Beard in the county of Essex, was presented in 1805 to the Society for the Encouragement of Arts and Manufactures; and a premium of forty guineas, with a silver medal, was awarded to the inventor for his valuable improvements.

Pricking the leather.—The holes in the leather, in which the staples are inserted, were formerly made by a manual operation with a double awl; lines were first drawn parallel to each other, by means of teeth at equal distances, and drawn at right angles to one side of the piece of leather to be pierced. The lines thus drawn regulated the perforations in one direction, and the distance between them in another direction was regulated by the eye, and the movement of the hand of the workman; but this operation is now performed with more accuracy and rapidity, by means of machinery. The leather to be pierced is stretched tight in the machine, and as it passes over a brass bar it is perforated by a double row of prickers, placed transversely in another brass bar, which is strongly secured by screws in a frame which moves vertically by a lever; the lower brass bar has also two rows of perforations, which correspond exactly with the steel points or prickers fixed in the upper bar. By the pressure of the lever, which is wrought by the right hand of the workman, a double row of perforations is made. That part of the machine, or the carriage in which the leather is stretched, moves horizontally by the action of a weight which operates by means of a cord passing over a pulley. The teeth of a rack attached to one side of the carriage, work in an endless screw, which is fixed on the end of a long axis placed parallel to the direction of the carriage. On the other end of this axis a cylindrical brass wheel is fixed, and on the circumference of this wheel circles are traced, each of which is equally divided, but with a different number of divisions. A spring is so fitted that it applies to the divisions, and a projection or tooth at the end of the spring enters the small holes in the circles, and thus prevents the revolution of the axis which would take place by the effect of the weight and the action of the rack-work of the carriage on the endless screw. While the tooth of the spring is in one of the holes of the circle, the machine is at rest, and the workman presses down the lever, and forms a number of perforations in the leather corresponding to the steel-points in the upper brass bar. The lever is then lifted up, and the workman, with his left hand, raises the spring, which allows the axis to move till the tooth enters the next hole in the circle by the elasticity of the spring; and the carriage being again at rest, another double row of perforations is made in the leather. In different kinds of cards the teeth are set at different distances; and for this purpose the distance between the different rows of perforations must be accommodated. This is easily accomplished by the simple contrivance of perforating the circles on the cylindrical wheel with a greater or less number; thus, if 12 holes are made in the circumference of one circle, and only six in that of another, while the spring acts on the first, 12 double-rows of perforations will be made in the leather, and while it acts on the second, six rows only will be made on the same space.

The leather being pierced, and the staples doubled and bent in the manner already described, they are inserted by the hand, and, after they are inserted, they are carefully examined by an experienced workman, to see that all the teeth are regularly set. The finer kinds of cards, which are used in the preliminary process of cotton-spinning, undergo another operation. To remove any roughness or inequality of the teeth they are fixed on an iron cylinder, and while it is turned round by one person, another applies a bar of wood, on which is spread a quantity of emery to give them a smooth polish.

Cards are distinguished by different names, according to their form or the mode in which they are wrought; thus *hand-cards* are nearly of a square form, and are nailed on pieces of wood to which handles are attached, and have their name from being wrought by the hand; *sheet-cards* are of a large size, to cover cylinders which are moved by machinery; and *fillet-cards* are made on narrow pieces of leather, which are fixed spirally on cylinders moved in the same way.

Pointed teethed cards.—A very essential improvement has been made in the construction of cards, by Mr Stead, of the card manufactory, Leith. Like every other valuable improvement, it is remarkable for its simplicity; and to the kindness and liberality of that gentleman we are indebted for permission to extract his own account of the invention, from a copy with which he favoured us of the specification of his patent, which extends over Great Britain and Ireland. According to his description, instead of the ordinary form of cards now in use, the teeth of this card are tapered gradually from what is called the knee, or from the leather or material in which they are set, and terminate in a sharp point in the form of a heckle. By this means the cards can be filled with wire of a much stronger and coarser size than they could be without this method of pointing, and they can also be filled closer in the wire, so as to combine the advantage of a fine card with the strength of a coarser one, without injury to the materials carded. The teeth of this card are made with either a kneed or circular hook; the latter is preferable, especially in the carding of flax, tow, and silk, as the card is more easily relieved and cleared of the stuff. Another improvement from this method of making cards is, that the teeth, owing to their form, may be grinded or sharpened repeatedly, until worn down, without loosing essentially the benefit of the original point.

The operations of pointing and polishing the points are executed by women, and the grinding and polish-

Cardmaking ing apparatus is fixed on a long axis, which is driven by machinery. The point is formed by grinding on a small grind-stone. The wires are then passed to another person to smooth and polish them; and, to save time and abridge labour, a considerable number is done at one operation by gently twirling them between the finger and thumb while they are pressed on the polishing apparatus, and thus every part of the circumference of the tooth is brought in contact with the polishing machine. Although the teeth were originally cut precisely of the same length, their extremities are apt to be worn down unequally during these operations; and thus it becomes necessary to arrange and sort the whole, that teeth of the same length may be employed in the same cards. This is done by means of a gauge similar to what is used in the original cutting of the wires. The other operations of doubling and bending are performed in the usual way. The manufacture of this excellent description of cards is now successfully conducted by Messrs Stead and Paterson, under the privilege of the patent already alluded to.

Improved machinery.—The machinery for abridging the labour of card-making has been still farther improved. Mr Fryer of Rastrick, near Huddersfield in Yorkshire, has invented an apparatus, by which the leather is pierced, and the wires previously doubled are inserted, and, after insertion, receive the knee-bend. But the most complete machine for card-making is the invention of Mr Amos Whittamore, an American. From the date of his invention in 1797, he obtained a patent for the exclusive privilege of using these machines for 14 years; and, from an account drawn up in 1809, by William Whittamore of West Cambridge, in the state of Massachusets, and one of the proprietors of the works, it appears that he had, in conjunction with the patentee, erected 55 of those machines, of which 37 were at that time in use. The amount of capital required for the concern is stated at 40,000 or 50,000 dollars; 40 persons are employed in the manufactory, and the weekly produce of their labours amounts to 180 dozen pairs of hand-cards, and 200 square-feet of cards for the woollen and cotton manufactures. It appears from the report, that the wire manufactured in America is greatly inferior to English wire for card-making, and this inferiority in the quality of the wire is ascribed to the want of capital, and of encouragement to the manufacture.

This ingenious machinery has been introduced into England under the privilege of a British patent, granted to the American patentee, in conjunction with Mr Joseph Dyer of Manchester. Mr Dyer, it is understood, has brought the apparatus by his own improvements to a high degree of perfection; and if a favourable opinion can be formed from the beauty of the manufacture, which, in the regularity and uniformity of the teeth of the cards, is far superior to what are made in any other way, these machines, when the period of the exclusive privilege has expired, must undoubtedly take the place of all others that have been hitherto invented.

In the apparatus now alluded to, the whole operations of cutting the wires, doubling them, piercing the leather, inserting the staples, and forming the knee-bend, which is done after insertion, are performed by machinery. A single wire only is completed at a time; but the rapidity of the action is so great, that four wires can be prepared and inserted in a second; and from this account it appears, that the whole operations are completed sooner by the improved machinery, than any individual operation in the usual way.

Cards. CARDS are oblong pieces of fine pasteboard, which are employed in various well known games for amusement. Cards are supposed to have been invented about the year 1390, for the amusement of Charles VI. of France, who had fallen into a state of melancholy. The four suits or colours are meant to represent the four classes of men in the kingdom. The hearts allude to the choirmen or ecclesiastics. The nobility or military part of the nation is represented by the points of lances or pikes, which are called in English *spades*, perhaps from the Spanish word *espadas*, signifying swords. Citizens, merchants, or tradesmen, are designed by diamonds or square stones, tyles, or the like; and the trefoil leaf which has been corrupted into clubs, alludes to husbandmen and peasants. The English names, it may be observed seem to have been borrowed from the Spaniards.

The four kings are David, Alexander, Cæsar, and Charles, in allusion to the celebrated monarchies of the Jews, Greeks, Romans, and Franks under Charlemagne. Argine, the anagram of *Regina* queen, Esther, Judith, and Pallas, expressive of birth, piety, fortitude, and wisdom, are alluded to by the queens. These names were on the French cards. The knaves, according to the original meaning of the word, were intended to represent the servants or attendants of knights. See GAMES.

CARDAMINE, CUCKOO-FLOWER, a genus of plants belonging to the Tetradynamia class, and of which several species are natives of Britain.

Cardan. CARDAN, a celebrated mathematician and medical writer, was born at Pavia in Italy in 1501, was the illegitimate offspring of an advocate at Milan, and was instructed by his father in mathematics, astronomy, and judicial astrology, in which latter he seems to have been a firm believer and an expert practitioner. In his 22d year, he gave lessons on mathematics at Pavia; ten years afterwards, he was appointed to the professorship of the same science at Milan; and at the same time he commenced medical practice, from which, or from his writings, he acquired a high reputation; for in 1552, he was called to visit the archbishop of St Andrews in Scotland, and had the good fortune to cure the primate of an asthmatic disorder; and in some part of his works, he notices some of the objects, connected with natural history, which he observed in the king's park at Edinburgh, during his visit to Scotland at that time.

On his return to Milan, after nearly a year's absence, he resumed his former occupations, both of a public and private nature, and continued till the year 1559, when he accepted the professorship of medicine at Pavia. In the succeeding year he was appointed to the same chair at Bologna, in which situation he continued for 10 years. But for some public offence, the nature of which is not stated, he was thrown into prison, and at the end of some months, having regained his liberty, he retired to Rome, and received a pension from the pope, which was continued till his death in 1575.

The life of this singular man seems to have been strongly marked with restlessness and caprice, while it displayed powerful talents and great industry. It is said that he was greatly addicted to gambling, and in this pursuit squandered his property. In mathematical investigations, and particularly in the manner which he treated the subject of cubic equations, he holds a respectable rank, although it is alleged that he was indebted to others for some hints on the subject. But considering the period in which he lived, and the prevailing studies of the times, he cannot be fairly charged with being altogether devoid of reason or intelligence when he wrote on judicial astrology, a subject which had occupied the attention of the most learned men of his age. He was peculiarly unfortunate in his family; his sons were of the most abandoned characters; and one of them forfeited his life to the laws of his country for destroying his wife by poison. The works of Cardan, which are extremely various and numerous on the subjects already alluded to, were published at Lyons in 1663, in 10 vols. *folio*.

CARDIAC, derived from the Greek word which signifies the *heart*, denotes, in a medical sense, something which is beneficial to that organ; and *cardiacs*, in a more enlarged acceptation, are synonymous with cordials which promote and invigorate the powers of digestion.

CARDIALGIA, a sensation of heat and acrimony at the upper orifice or entrance into the stomach, and denominated in English *cardiac passion* or *heart-burn*. See MEDICINE.

CARDIFF, the county town of Glamorganshire in South Wales. See GLAMORGANSHIRE.

CARDIGANSHIRE, a county of South Wales, which is bounded on the north by Merionethshire, on the west by Cardigan bay, on the south by Caermarthen and Pembroke, and on the east by Radnor and Brecknock; and is about 40 miles in length, 20 in breadth, and 100 in circumference. The western side has suffered by the encroachments of the sea, and where flourishing towns are supposed to have formerly existed, a few villages now remain. The county may be divided into two districts, the lower and the upper. Of the elevated grounds of the lower district, the soil is generally a light sandy loam, from four inches to a foot in depth, but the soil of the vallies is deep. Good crops of wheat, barley, peas, oats, turnips, and potatoes, are raised. Cows are extensively reared by the farmers, but the number of sheep is declining. Cheese is manufactured, partly for exportation and partly for domestic use. The upper district is mountainous, and the soil of the vallies is of a stiff clay, with a mixture of light loam. The rearing of cattle and horses is the main dependence here, together with sheep and pigs. The waste lands in Cardiganshire are very extensive, probably from a want of industry in their cultivation; but improvements have been proposed, and are going on promisingly. The climate is mild and favourable, and snow seldom lies long.

The principal rivers are the Tivy, the Rydol, and the Ystwith. The Tivy rises from one of the small lakes to the eastward, and, pursuing an irregular course, falls into the Irish sea about two miles below Cardigan. The Rydol rises on the south-west side of Plynlimmon, and discharges itself into the Irish sea near Aberystwith; and the Ystwith rises among the hills in the eastern district; and springs are very general on the hills and vallies, some of which, after heavy rain, become impetuous torrents.

Lead and some other minerals which are found in the mountains in the north of the county, were formerly wrought to advantage, but they are now neglected. Rich veins of copper have likewise been discovered, which cannot be wrought owing to the great want of fuel.

The population of Cardiganshire was stated, in 1801, at 42,956, and had increased in 1811 to 50,260. The principal manufactures are the iron and tin works. A good deal of wool is spun, and the fishing in the bay of Cardigan occupies a number of the inhabitants. The chief exports are iron, tin, black cattle, pigs, salt butter, barley, and oats. Several fairs are held, where much business is transacted in the commodities of the place. This county contains several market towns, of which Aberystwith and Cardigan are the chief.

Cardigan, the county town, stands on a steep bank, about two miles from the mouth of the river Tivy, which is navigable for vessels of more than 100 tons burthen. Cardigan had at one time a considerable commercial intercourse with Ireland, but its chief trade is in iron, the produce of the works in the neighbourhood. The population exceeds 2000. See ABERYSTWITH.

CARDINAL, derived from the Latin word which signifies *a hinge*, is an appellation expressive of superiority or pre-eminence, as the cardinal virtues, justice, prudence, temperance, and fortitude, which are supposed to be the foundation of all the rest; the cardinal points, or chief regions of the heavens, which are north and south, east and west; and the cardinal winds, which blow from these points.

CARDINAL, a dignitary of the church of Rome, next in rank to the pope himself. Of the origin of cardinals no distinct account is recorded, but they now compose the council or senate of the pope, and form the conclave for the election of the head of the church; and for the regulation of their rights and titles, a constitution drawn up by Pope John is preserved in the Vatican.

In the first institution of cardinals they were only the principal priests, or incumbents of the parishes of the city of Rome; in the primitive church, the chief priest of a parish, next in rank to the bishop, was called *presbyter cardinalis*, to distinguish him from the inferior priests who possessed no benefice. The duty of baptising and administering the eucharist, was committed to these cardinal priests alone, and when they were created bishops they were considered as being raised to a higher dignity, and having vacated their benefice. Three kinds of churches were originally established. To the first, parishes were attached; the second were called deaconries, which were chapels belonging to hospitals, and served by deacons; and the third were oratories, in which private masses were said, and the other duties of which were discharged by local or resident chaplains. The principal, or parish church, was denominated cardinal, to distinguish it from the others, and the officiating minister was called *cardinal priest*. Some chapels also conferred the title of *cardinal deacon*. It was not till about the 11th century that cardinals obtained a higher rank than bishops, and, according to the constitution already alluded to, the pope is supposed to represent Moses, and the cardinals the 70 elders of Israel. But it appears that this institution, deriving its origin from small beginnings, has varied greatly in the number of its members. The cardinal deacons were at first only seven, and were afterwards increased to fourteen. The number of cardinal priests was 50, and, with the six cardinal bishops, made up the whole number of 70. The number was reduced by the council of Constance to 24, but Pope Sextus IV. raised it to 65.

When cardinals are created, they receivered caps, as a badge of the rank to which they are promoted, from the hands of the pope himself, but if they are at a distance, the cap is transmitted by some person of rank: they wear a prescribed dress, which consists of a rochet, over which is a short purple mantle, and their garments are either red or violet. Cardinals were formerly addressed *most illustrious*; but by a decree of Urban VIII. in 1630, this title was changed into *eminence*. All matters, whether of a political or ecclesiastical nature, connected with the see of Rome, are submitted to the cognizance of the cardinals, and they not only claim the power of electing the pope, but assert the privilege of choosing one of their own body.

CARDIUM, or Cockle, a genus of shell-fish, belonging to the order of Bivalves, of which one species *cardium edule*, or common cockle, is found in immense numbers on many of the sandy shores of Britain, and is much employed as food by the inhabitants.

CARDONA, a town of Catalonia in Spain. See Catalonia.

CARDUUS, the Thistle, a genus of plants belonging to the Syngenesia class.

CAREENING, in maritime affairs, denotes the operation of making a ship incline to one side, for the purpose of caulking or repairing those parts of the bottom which are usually under water. This is done by the weight of the ballast, which is placed on one side, or in ships of war, by means of the guns.

CARELIA, the eastern province of Finland, is divided into Swedish Carelia and Muscovite Carelia.

CARELSCRONA, or Carlscrona, a sea-port town of the province of Blekingham in Sweden; was founded in 1680 by Charles XI. from whom it derives its name, as a naval station. The chief part of the town stands on a rocky island, between which and the main land a communication is formed by means of two wooden bridges. The houses are mostly of wood; and the public buildings, as the town-house, the arsenal, and some of the churches, are elegant structures. The harbour is spacious and commodious, and with depth of water for the largest ships. It is capable of receiving more than 100 vessels, while it is strongly protected both by nature and art. Large docks, fit for receiving first rate ships of war, have been dug out of the solid rock, and constructed at an immense expense. The population is about 13,000 or 14,000; and the inhabitants are chiefly employed in ship-building, or in those arts which are immediately connected with it, beside some trade in deals, pitch, tar, and other productions of the surrounding territory. The governor of the province has his residence in this place; and it is one of the four towns in Sweden in which the Jews are permitted to erect synagogues.

CAREX, Sedge Grass, a genus of plants belonging to the Monœcia class.

CAREY, Harry, an English poet, who flourished in the early part of the 18th century, was the author of various songs which were sung in modern comedies, as those in the *Provoked Husband*, and of several dramatic pieces, intended as satires on some of the modern tragedies and the Italian opera. Such are his *Chrononhotonthologos*, and the *Dragon of Wantley*, the first of which still appears occasionally on the stage, A collection of all his songs, entitled the *Musical Century*, was published in 1740. He was also distinguished by his musical genius; and some of the airs to which his songs were sung were of his own composition. But, like many poets, prudence and economy were not always his steady guides; his income and expenditure, it would appear, were altogether disproportionate; and he often laboured under great pecuniary embarrassments, which led him, in 1744, in a fit of despair, to the commission of suicide.

CARIA, an ancient kingdom of Asia Minor, which is supposed to have had the Mediterranean sea for its boundary on the south, the Ægean sea on the west, Ionia on the north, and Phrygia on the east, and seems to have held a conspicuous station in the early history of the world. Caria became afterwards subject to the Persians; and the Carian fleet, which had joined Xerxes against the Greeks, was the last which retired from the decisive victory of Salamis. The Carians afterward maintained many severe struggles with the Greeks; and in a later period of the history of this country, it has shared the fate of Asia Minor.

CARIBBEE ISLANDS, a cluster of islands in the Atlantic ocean, which are included between the 11° and 19° of N. Lat. and are arranged in a semicircular form. See America.

CARICA, the Papaw, a genus of plants belonging to the Diœcia class. See Botany.

CARILLONS are musical instruments, composed of a series of bells accurately tuned to the tones and half tones of the scale, and furnished with keys, like those of the harpsichord or organ, which the player, or *carilloneur*, strikes with his hands; and those connected with the large bells have pedals, on which he acts with his feet. A series of bells of this description is common in the steeples of the churches in Holland and the Netherlands, and is not unknown in the northern parts of Britain, as in Edinburgh, Glasgow, and Stirling.

CARINI, a town of Sicily, with a population of 5 or 6,000, stands in a fertile valley, which is well cultivated, and produces all kinds of grain and fruits.

CARINTHIA, a duchy of the circle of Austria in Germany, bounded on the east and north by Styria, on the west by Tyrol, and on the south by the Venetian territories and Carniola. It is about 118 miles in length, and 50 in breadth, and is surrounded by walls and a ditch. The country is mountainous and woody, and the vallies are fruitful, producing grain of different kinds, though not in sufficient abundance for the consumpt; and some flax is also raised. Cyder, and two kinds of ale are common; and turpentine is successfully procured here. Great numbers of cattle and horses are maintained on the pastures. Swine are abundant; and in the forests are found wild goats and bears. The climate is not unfavourable, though coldish. Lakes are not unfrequent; the largest is the Wordtsee, eight miles long; and the chief river is the Drave, which traverses the country from west to east, and which, with the Gail, the Moll, the Lyser, the Glan, the Gurk, and the Lavant, abounds in fish.

Carinthia is very productive of minerals, as iron, copper, lead, of which there are several mines, calamine, bismuth, granite, marble, alabaster, nitre and bolar earth.

The population in 1810 was 300,000; and the industry of the inhabitants is chiefly occupied in manufacturing the produce of the mines, which is the main source of wealth, together with the preparing of goats and chamois skins. The exports are iron, steel, lead, copper, calamine, flax, linen, hides, and vast numbers of cattle, which are sent to Venice. Among the imports are wines, spirituous liquors, sugar, cotton, coffee, drugs, corn, cloth, and salt.

Carinthia is divided into the lower and the upper. The principal towns of the former are Klagenfurth, which is considered the capital, St Veit, Friesach, Volken, St Andrée, Wolfsberg, and Gurk; and those of the upper are Villach and Gmund.

CARLINA, the Carline Thistle, a genus of plants belonging to the Syngenesia class.

CARLINGFORD, a sea-port town of the county of Lowth in Ireland, and about 22 miles north from Drogheda.

CARLISLE, a city of Cumberland in England. See Cumberland.

CARLOW, an inland county in the province of Leinster, in Ireland, is bounded on the north and west by Kildare, Queen's-county, and Kilkenny, and on the south and east by Wicklow and Wexford, is chiefly included between the two principal rivers the Barrow and the Slaney, and is about 33 miles in length from north to south, and nearly 30 miles at its greatest breadth. That part of the county to the westward of the river Barrow is mountainous and rugged; and another lofty ridge, equally bleak and barren, stretches along the south-eastern quarter; but in the flat part of the county, and the less elevated districts, the soil is fertile and well cultivated. Granite is the prevailing rock in some of the high mountains; limestone is abundant in some places; some marble is met with; and the ores of iron were at one time wrought, and furnished materials to a considerable foundery which existed in the time of Charles I. The river Slaney traverses part of the county on the east, and the Barrow is navigable to the town of Carlow, from which it communicates with the Dublin canal.

Carlow is divided into five baronies and 50 parishes. The population is stated at 44,000; and the proportion of the Catholic and Protestant inhabitants is said to be 10 of the former to one of the latter. Tillage husbandry is not prosecuted on a large scale in this county; but a great deal of barley, of a superior quality is raised, and sent to different parts of Ireland. The dairy husbandry is an object of great attention, and the produce in butter bears a high character both in the London and Dublin markets. The principal towns of Carlow are, Carlow, the county town, Tullow, Leighlinbridge, Rutland, Palatine-town, Hacketstown, and Gousbridge.

Carlow, the county town, stands on the east side of the river Barrow, is pretty regularly built, was formerly surrounded with walls, and defended by a castle; contains about 7000 inhabitants, including the village of Grange, which is in Queen's-county, and connected by a bridge, and has some manufactures of coarse woollen cloths, and hardware, as shears, scythes, and reaping-hooks. Among the public buildings is a seminary for the education of Roman Catholic priests; and the ruins of a fine abbey are still visible.

Leighlinbridge is also situated on the Barrow, is seven miles south from Carlow, and is chiefly remarkable for a very large corn-mill.

CARLSBAD, a town of Bohemia, stands on the river Eger, is famous for its hot springs, and celebrated for its manufactures of tin and steel, and particularly for the fabrication of arms. The population is stated at 3000, which sometimes, during the bathing season in June and July, receives an accession of strangers equal to that number. The temperature of the different springs varies from 120° to 165° of Fahrenheit; and the saline ingredients which enter into their composition are, Glauber salt, common salt, carbonate of soda, and a portion of lime.

CARLSCRONA, a sea-port town of Sweden. See Carelscrona.

CARLSRUHE, a town in the circle of Swabia, and marquisate of Baden, in Germany, was founded about the commencement of the 18th century, and is built on a regular plan. The streets are uniformly arranged, and the houses are of the same size and height. The palace, some of the churches, and houses for public institutions, are elegant structures. The population is about 10,000. Some manufactures have been introduced, particularly watch-making and works in steel.

CARLSTADT, a town of West Gothland in Sweden. See Gothland.

CARMAGNOLA, a town in the marquisate of Saluzzo in Italy, is situated near the river Po, is strongly fortified, and, including the suburbs, contains 12,000 inhabitants. The surrounding territory is fertile, and produces abundance of grain, flax, and silk.

CARMEL, a lofty mountain of Palestine, which forms a remarkable promontory on the shore of the Mediterranean, by which it is bounded on the west, has the bay of Acre on the north, and the plain of Sharon on the south; is said to be about 2000 feet in height; is celebrated in Scripture on account of its fertility; and, even in the present day, the wild vine and the olive are seen rising among the brambles and native plants; but its sides are steep and rugged, and in many places the naked rock presents itself. Other places which were remarkable for their fertility, were distinguished by a similar appellation. This mountain is known in Scripture as the abode of Elijah and Elisha; and from this circumstance it has been since held in great veneration by Jews, Christians, and even Mahometans.

A monastic institution, deriving its name from the mountain, and called the order of Carmelites, was very early established; and a convent of the same order still remains. The ancient monastery is in ruins, and a Mahometan mosque has been erected.

CARNATIC, a country of Hindostan, which lies on the east side of the Indian peninsula. See HINDOSTAN.

CARNEADES, a celebrated Greek philosopher, and founder of the third academy, was a native of Cyrene in Africa; and one of the grand principles of his philosophy was, that there are only probabilities or resemblances of truth in the mind of man, so that, of two things directly opposite, either may be chosen indifferently. He died in the fourth year of the 162d Olympiad, and when he had reached nearly the 90th year of his age.

CARNELIAN, a species of mineral belonging to the siliceous genus, which derives its name from its reddish flesh colour, but is sometimes yellowish and whitish. See GEOLOGY.

CARNICOBAR, one of the cluster of islands in the bay of Bengal, called Nicobar. See NICOBAR.

CARNIOLA, a duchy of the circle of Austria in Germany, is bounded on the east and south by Dalmatia and Croatia, and the Adriatic sea, and part of Istria, and on the west and north by the same sea, and Friuli, and Carinthia, and Styria, is about 120 miles in length, 100 miles at its greatest breadth, and exhibits in general a mountainous aspect. Some of the mountains are always covered with snow, and one of them rises more than 10,000 feet above the level of the sea. But numerous fertile vallies and rich fields present a fine contrast to the elevated and less productive districts.

Several lakes, some of which are of considerable extent, are found in the province; and the chief rivers are the Sare, the Laybach, and the Gurk, to the first of which the others are tributary streams, and discharge their mingled waters into the Danube at Belgrade. The ores of iron are abundant in some places, and one mine furnishes excellent materials for the manufacture of steel. Mines of lead and copper have been also wrought; but the rich mines of quicksilver in Idria are by far the most famous and most productive. They were discovered in 1497.

Wheat, barley, and rye, with millet and buckwheat, which latter is raised on the lighter soils, are among the cultivated crops. Flax and hemp are also objects of culture; and some of the rich fruits of warmer climates are produced in abundance. The pastures afford support to numerous herds of cattle and large flocks of sheep. The breed of horses is of middle size, but strong and hardy. The production of silk also gives occupation to the industry of the inhabitants.

The population of the whole duchy is stated at 433,000. The working of the mines, iron forges, glass-making, delft-ware, tobacco-pipes, woollen stuffs, and hosiery, spinning-works, and lace and linen manufactories, afford employment to a large proportion of the inhabitants. Iron, steel, quicksilver, wines, olive oil, olives, and other fruits, honey, cheese, horses, cattle, linen and woollen stuffs, with various ingenious works in wood, constitute the principal exports from the province; but grain, of which the quantity raised is not sufficient to the demand, is imported. The chief towns are Laybach, Trieste, and Ydria, or Idria.

Laybach is the capital, is accounted a fine town, with some elegant houses and public edifices, is traversed by a navigable river of the same name, and contains about 20,000 inhabitants.

Trieste is the chief port of rendezvous for the Austrian marine, is the point of communication between the empire and the different ports of the Mediterranean. The town is well built; the streets are spacious; and the number of vessels, amounting to more than 5000 annually, which frequent its port, which is safe and commodious, is a sure indication of the extent of the trade. *Idria*, with nearly 4000 inhabitants, is chiefly connected with the mines of quicksilver in its vicinity.

CARNIVAL, a grand festival, or season of rejoicing, which is observed in different parts of Italy, and particularly at Venice, and usually commencing from the twelfth day, and continuing till Lent. Feasts, balls, operas, concerts of music, and all kinds of amusement, are exhibited in carnival time. With such attractions, which are peculiarly imposing at Venice, strangers resort to it from all quarters; and, on some occasions, not fewer than 30,000 visitors have been within the city at the same time.

CAROLINA, NORTH, one of the United States of America, has for its boundary on the east the Atlantic Ocean, Virginia on the north, and on the south and west, South Carolina, Georgia, and Tennessee, is about 450 miles long, and 180 miles at its greatest breadth, and includes a superficial area of 34,000 square miles. A dead level, covered with thick forests, extends 60 miles from the sea coast, and is succeeded by a varied surface of mountainous scenery, which brings into view a rich country towards the westward, clothed with stately and extensive forests, and watered by the copious stream of the Tennessee. The soil in the flat districts is rich and fertile; in the western tracts of the state the finest kinds of timber are inexhaustible; and in the mountainous regions, the grain of the northern climates is successfully cultivated.

The diversity of climate is considerable in North Carolina. In the flat and swampy districts, fevers and inflammatory diseases are prevalent; but in the hilly country the air is pure and salubrious; and the inhabitants enjoy all the vigour of life to advanced age

The Chowan river has its origin in Virginia, and having received in its course various tributary streams, is three miles broad where it falls into Albemarle sound. The course of the Roanoke is long and rapid, full of water-falls, and is only navigable for small vessels about 60 miles from its mouth. It terminates in the same sound. The Pamlico or Tar river, which flows into Pamlico sound, admits vessels which draw not more than nine feet of water forty miles of its course. The Neus river also falls into Pamlico sound, and is navigable for ships of considerable burden for twelve miles beyond the town of Newbern, for small craft fifty miles, and for boats 200 miles. The fine stream of the Tennessee traverses the western districts of North Carolina, and at last joins the Ohio.

The population of North Carolina exceeds 563,000. The inhabitants are commended for their hospitality, but they are charged with indolence and excessive dissipation; they are chiefly employed in husbandry. Wheat, rye, barley, oats, and Indian corn, are the principal kinds of grain which are cultivated. In some places flax and cotton are raised. Pitch, tar, and turpentine are extracted from the lofty pitch pines which abound in the plains. The chief commercial intercourse is with the northern states, the West Indies, and Europe. The chief towns are, Wilmington, Newbern, Edenton, Halifax, Hillsborough, and Fayetteville. Wilmington has the best harbour in North Carolina, to which ships of 300 tons burden are admitted, and it enjoys the greatest trade. Newbern stands on the river Neus, where it joins the Trent, and about 100 miles from the sea. Edenton is built on the banks of the river Roanoke, near the point of Albemarle sound. The river admits ships of 150 tons burden to this place.

CAROLINA, South, one of the United States of America, has North Carolina for its boundary on the north and north-east, Georgia on the south and south-west, and the Atlantic ocean on the east, includes an area of nearly 2,500 miles, and forms two natural divisions, distinguished by the names of upper and lower. A plain, stretching 100 miles westward from the Atlantic ocean, and covered with thick forests, level fields, and swampy soil, is succeeded by an undulating range of sand hills. A fertile, well watered, and well cultivated tract called the *ridge*, so named from its elevation, presents a lofty front to the eastward, and extends towards the west, beyond which an agreeable variety of hill and dale land is seen. Some of the mountains in the western district rise to a considerable height. Table mountain is 3000 feet from its base, and 4000 feet above the level of the sea.

The rivers of South Carolina are numerous, and where they traverse the flat country, their banks are generally swampy, but some of them, as Broad river, Coosaw, and Port-royal, are rather to be considered as arms of the sea, and have a sufficient depth of water for large ships. The Pedee, Black river, Santee, Wandow, Cooper, Ashley, and Savanna, are all navigable in some part of their course.

The soil of this state, which is swampy or alluvial, is extremely fertile. Little wheat, barley, or other grain is raised. Tobacco thrives well, but has not been extensively cultivated. Rice, indigo, and cotton may be considered as the staple produce. Fruits of all kinds are abundant. Beside domestic animals, squirrels, bears, wolves, and some other quadrupeds, with a great variety of beautiful birds, are common. The rivers and sea coasts afford inexhaustible stores of excellent fish.

The inhabitants of South Carolina, the number of which is stated at 250,000, are distinguished into four classes;—the planters, who have the largest incomes, and who can afford to live in the most expensive and luxurious style;—the farmers, with more limited resources, are more engaged in the labours of industry, and possess more moderate habits;—the cottagers, who were formerly in a depressed state, but now enjoy a larger share of the comforts of life;—and the squatters, who have been always troublesome neighbours, form temporary settlements, and live chiefly by hunting or plunder; but their condition, also, with regard to their moral and religious habits, has been greatly ameliorated by the exertions of the methodists.

The principal commodities of exportation are rice, cotton, indigo, and tobacco, with some Indian corn, staves, shingles, rosin, turpentine, and salt provisions. The principal towns of the state are Charlestown, Beaufort, Georgetown, Columbia, and Camden.

Charlestown stands near the confluence of the Cooper and Ashley rivers, and was founded by a colony of emigrants from England in 1680. The chief streets run in a straight line between the two rivers, and are intersected by other streets nearly at right angles. The exchange, state-house, armoury, and some hospitals, are the principal public buildings, and some of the private houses are not destitute of elegance. The population exceeds 16,000, of which the slaves compose nearly one-half. The trade of Charlestown is considerable; and for more than 100 years it continued to be the seat of government, but it has been changed to Columbia.

Beaufort stands on the island of Port-Royal, has a good harbour, and has the advantage of a college, established in 1795. *Columbia* became the seat of government in 1801. A college has also been founded at this place, and in 1809 was attended by nearly 90 students.

CARPATHIAN, or Krapack Mountains, an extensive and elevated chain, which forms the boundary of Hungary on the north and east.

CARPENTRY is the art of framing and joining pieces of wood, for the purposes of architecture. See Architecture.

CARPET, a kind of woollen stuff which is usually fabricated of different colours, and is commonly employed for covering the floors of rooms. See Cloth Manufacture.

CARPINUS, the Horn-Beam, a genus of plants belonging to the Monœcia class.

CARPOCRATIANS, a sect of the ancient Gnostics, which derives its name from Carpocrates, who revived some of their opinions in the second century.

CARRIAGE, a general denomination of every kind of vehicle which is furnished with wheels.

CARRICK, the southern district of Ayrshire in Scotland, presents great variety and inequality of surface, from which a great proportion is only adapted for pasturage. The chief rivers are the Girvan and Stinchar. The banks of the first are well wooded, and adorned with many beautiful seats of the chief proprietors.

CARRICKFERGUS, an ancient town and capital of the county of Antrim in Ireland, stands on the north side of the bay of the same name, and, according to tradition, was founded by Fergus the first king of Scotland. It seems to have been a place of considerable strength, defended by walls and a castle, which is erected on a projecting rock, and commands the entrance of Belfast loch. A small garrison is still kept at this place. The population is stated at 4000; but since the trade of Belfast has increased, Carrickfergus has declined. The court-house, at which the assizes for the county are held twice in the year, is an handsome structure. Carrickfergus is 9 miles N. E. from Belfast, and 89 miles from Dublin.

CARRON, a river of Stirlingshire in Scotland, which is remarkable for being the scene of several important events, and derives no small degree of celebrity from the extensive iron-works which are established on its banks, and distinguished by its name. See STIRLINGSHIRE.

CARTHAGE, one of the most celebrated cities of antiquity, the great rival of Rome, and capital of the empire of the Carthaginians, was situated on a peninsula near the middle of the northern coast of Africa, not far from modern Tunis, where ruins of the ancient city are still visible. It lies in East Long. 10° 40′, and North Lat. 36° 40′. It appears to have been founded about 970 years before the Christian era, by Elisa, or Dido, sister of Pygmalion king of Tyre, who being compelled to quit Asia by the tyranny of her brother, sailed with several ships and a considerable number of followers to the neighbourhood of Utica, where a Phœnician colony had for some time been established. In the time of its greatest splendour, about 220 years before Christ, the city is said to have been 23 miles in circumference, and to have contained a population of 700,000 souls. It consisted of three parts, *Byrsa*, or the citadel; *Megara*, the town; and *Cothon*, the harbour. It was admirably situated for commerce, had several noble quays, an extensive arsenal, and docks capable of containing above 200 ships. At present little is left but the remains of piers below water, part of a theatre, the ruins of immense water cisterns, and of an aqueduct of prodigious length and massy architecture, by which these reservoirs were supplied.

If we except their enterprising and warlike spirit, by which they maintained the most extensive commercial intercourse with Europe and Asia, and disputed the sovereignty of what was then called the world with the Roman republic, there is nothing in the character and manners of the Carthaginians which merits peculiar notice. They were barbarous, superstitious, and proverbially faithless; offered human victims to Saturn or Moloch, and appear to have had no pretensions to literature, though some eminent literary characters, especially Terence, are said to have been born at Carthage. But they were ingenious mechanics, and expert navigators; and by their voyages, (particularly that of Hanno, noticed under AFRICA,) contributed to extend the geographical knowledge of the globe.

The *government* of Carthage was of a mixed form, having the semblance of a republic, with the spirit of a monarchy. It resembled that of republican Rome in having a senate for legislation, and two chief magistrates called *Suffetes*, who differed from the Roman consuls in being withheld from military command. Both *Suffetes* and senators were elected by the people. A part of the senate, composed of 104 persons, formed the chief court of judicature, and five of this last court constituted a general *court of appeal*. Their military affairs, though superintended by a native general, were conducted by means of mercenary soldiers, and the general was made accountable for the good or ill success of his expeditions. Their *marine* force was always respectable, and their fleets the most numerous and formidable that had appeared before the Romans acquired the skill in naval affairs to which they were led by their contests with the Carthaginians.

History.—The early history of the Carthaginian empire is involved in obscurity and fable. It is understood that its founder, Dido, perished by her own hands, but whether to avoid a hateful marriage with one of the neighbouring princes, or out of despair at being abandoned by the Trojan chief Æneas, is uncertain. It is supposed that the monarchy established by Dido continued for nearly 300 years, a period which forms an inscrutable chasm in Punic history. We know only, that about 500 years B. C. a commercial treaty was entered into between the Carthaginians and the Romans, much to the advantage of the former, and that a few years before this period the Carthaginians had made descents on the opposite islands of Sicily and Sardinia, though without any considerable or permanent success. Soon after the conclusion of the treaty with Rome, the Carthaginians entered into an alliance with Darius Hystaspes and his successor Xerxes, kings of Persia, in consequence of which they fitted out a formidable expedition against Sicily, where the tyrant Gelo had acquired the sovereignty of the petty territory of Syracuse, and Theron that of Agrigentum. These princes united their forces to oppose the Carthaginians; and though the army of the latter consisted of 300,000 men, headed by Hamilcar, an able and experienced general, the expedition proved in the highest degree unsuccessful and disastrous. The general, with the greater part of his army, perished in the field, and nearly the whole of the fleet was either taken by the enemy or destroyed by tempests. This expedition was followed by a treaty between Gelo and the Carthaginians, much more favourable to the latter than could have been expected, but which they embraced the earliest opportunity to infringe. The war was renewed, and the Carthaginian generals carried several of the Sicilian towns by storm and treated the inhabitants with the utmost cruelty. At length, in the 4th century before the Christian era, when Dionysius had assumed the sovereignty of Syracuse, this subtle prince, in combination with the Agrigentines, formed a plan for exterminating the Carthaginian settlers in Sicily and liberating the island from their galling yoke. This plan was completely successful, owing in a great measure to a pestilential fever which broke out in the camp of Hamilcar the Carthaginian general, who had invested Syracuse in considerable force. Weakened by disease, and harassed by the besieged, the Carthaginian army was compelled to abandon the Sicilian territories. Another expedition under Mago ended in a similar manner; and a treaty was concluded, which continued with little interruption during the remainder of the reign of Dionysius the Elder, and the greater part of that of his successor of the same name. But as the Carthaginians still harboured the ambitious design of becoming masters of Sicily, the Syracusans, about 341 years B. C. applied for assistance to the Corinthians, and obtained the aid of that consummate general Timoleon. Under his direction the Carthaginians were repeatedly worsted, and compelled to sign a dishonourable peace. After this, little of moment occurs in the history of Carthage, till the time of Agathocles, tyrant of Sicily, between whom and the Carthaginians a dispute took place about 310 years B. C. Agathocles, though at first defeated, crossed the Mediterranean and invaded the territories of Carthage, where he committed dreadful ravages, and defeated the Carthaginian general in a pitched battle. But at length the tide of success turned against the Sicilian prince, and he was compelled to relinquish his ambitious designs.

Carthage had now acquired extensive territory and high reputation. Her dominion extended along the northern coast of Africa from Cyrene on the east to the straits of Gibraltar, and it is supposed she had now obtained footing in Spain. Her alliance was courted by the Romans, and in the war which this people carried on against Pyrrhus, they were materially assisted by the Carthaginians. But a jealousy soon arose between the two nations, and in consequence of the Carthaginians intermeddling with the affairs of Sicily, and opposing the Romans in an invasion of that island, a contest ensued, which has been distinguished by the name of the first *Punic war*. This war formed the commencement of a long and almost uninterrupted series of hostilities, which finally terminated in the destruction of the city and empire of Carthage. Only an outline of these wars can be given here, as the details fall more properly under the history of ROME. The first Punic war began about 264 years B. C.; and now for the first time the Carthaginians found themselves successfully opposed by sea. In 260 their fleet was defeated by that of the Romans, and they were attacked on land by a powerful army under Regulus. The defeat of this general, however, in 256, raised the spirits of the Carthaginians; but a second naval defeat which their general Hamilcar sustained in 242, B. C. compelled them to sue for peace, the terms of which were extremely humiliating. Thus ended the first Punic war; but Carthage now found herself embroiled with the mercenary troops which had been employed against the Romans. This contest, called by historians the *Lybian war*, terminated in 238 B. C. and the following year an expedition under Hamilcar and his son Hannibal was fitted out for the conquest of Spain. Here they were so successful as to rouse again the jealousy of the Romans; and in consequence of Hannibal laying siege to the town of Saguntum, a Spanish port, then occupied by the Romans, the *second Punic war* began in 219, B. C. In this war the military genius of Hannibal was eminently conspicuous. Passing the Alps he transferred the seat of war to the Roman territories, and successively defeated their generals at *Thrasymene* and at *Cannæ*; but these successes were only transient. He was soon opposed by Scipio; and, after maintaining an unequal contest for 17 years, the Carthaginians found themselves under the necessity of concluding another humiliating treaty. Peace continued between these rival states till the middle of the 2d century before Christ, when the *third Punic war* began, and, after a short struggle of three years, the Romans obtained the sovereignty of Africa.

The history of Carthage, after its destruction by the Romans, possesses little remarkable or interesting. A new city, near the site of the ancient ruins, and under the same name, was built by the Romans, and is represented by Strabo and Pliny as a place of considerable importance. It continued to flourish till the invasion of the Roman empire by the Vandals in the early part of the 5th century, when it was finally destroyed by these barbarians.

CARTHAGENA, a sea-port town of the province of Murcia in Spain. See MURCIA.

CARTHAGENA, a province of the viceroyalty of New Grenada in South America, and also the capital of the same province. See GRENADA.

CARTHAMUS, or SAFFRON-FLOWER, a genus of plants belonging to the Syngenesia class, and of which one species, *tinctorius*, is employed as a dye-stuff.

CASAL, a town on the banks of the Po in Italy, is a place of considerable antiquity, became a free city towards the close of the 12th century, and about the end of the 14th century a royal residence. The population is about 14,000; and some of the ancient and distinguished families are said to be descended from the early Romans. The same name is applied to another town, which is also situated on the banks of the Po, and contains a population exceeding four thousand.

CASAUBON, ISAAC, a learned critic and editor of ancient classical works, was a native of Geneva, and was born in 1559; at an early age gave strong proofs of great facility in the acquisition of languages; and under the tuition of his father, a clergyman in Dauphiny, he made great progress in the Latin tongue. In 1578 he removed to Geneva, in the view of prosecuting his studies, and acquired such interest or reputation as to be promoted, in his 23d year, to the professorship of Greek, which he held for 14 years; and during this period he married the daughter of Henry Stephens, the celebrated printer, and by her had a numerous family of 20 children. Having accepted a chair in the university of Montpellier for the purpose of teaching the same language, he found, in a short time, that he did not enjoy that comfort and happiness which he expected, and embraced the opportunity which offered of visiting Paris, where he had the good fortune of being introduced to Henry IV., was nominated keeper of the royal library, and received a pension from the king, which enabled him to pursue his literary avocations.

The assassination of Henry in 1610 blasted all his hopes; and the rancorous feelings which existed between him and the Roman catholics determined him to accept an invitation from James I. of England, where he was well received by the learned monarch, and greatly esteemed by many persons of rank and literary distinction, was preferred to a prebend at Westminster and to another at Canterbury, and seems to have entered deeply into some literary correspondence concerning events connected with the history of Mary of Scotland. Casaubon died in 1614, and was buried in Westminster-abbey. The Greek and Latin classics which he edited, and of which a catalogue may be seen in *Biographia Britannica*, afford ample proofs of his profound erudition.

CASBIN, or CASVIN, a city of the province of Irak-Ajami in Persia, stands in a wide plain, encompassed by mountains, was once of great extent, and included 100,000 inhabitants; but its splendid buildings and magnificent palaces were destroyed by an earthquake, and now present a heap of ruins. The present population is variously stated at 20,000, 25,000, and even as high as 60,000. Excellent wines and rich fruits are produced in the neighbourhood. Silk and cotton stuffs, a fine kind of tapestry, works of iron and steel, and particularly fire-arms and watches, are manufactured.

CASE, a term in grammar which denotes the different inflections or terminations of nouns, and is expressive of the relation to the objects which they represent.

CASERTA, a city in the district of Lavora in Naples, and is chiefly remarkable for a splendid palace of Charles III. of Spain, which was begun more than half a century ago, and is not yet finished; and the aquæduct, 27 Italian miles in length, which conveys water from the Apennines for the supply of the place.

CASHAN, or KASHAN, a town of the province of Irak-Ajami in Persia, stands in the plain of Cashan, which is bounded by a distant ridge of mountains, some of which are of great height. The palaces, mosques, caravanseras, and market-places, and some sepulchral monuments, are peculiarly distinguished for their magnificence. The population, once nearly double, is now estimated at 30,000. Military weapons, as sabres, poniards, with copper utensils, silk and cotton stuffs, and brocade, are manufactured; and Cashan was once celebrated for its potteries.

CASHEL, a city of Tipperary in Ireland, is the see of an archbishop, and contains about 3000 inhabitants.

CASHEW-NUT, the seed or nut of the cashew-apple. See *Anacardium*, under BOTANY.

CASHMERE, or CACHIMERE, a province of Hindostan, between the 33° and 34° of north latitude, and is nearly 80 miles in length, and from 40 to 50 miles at its greatest breadth, and having the provinces of Lahore and Cabul on the south, has been always celebrated for its fine climate, rich soil, and picturesque beauties, in consequence of which it has received the distinctive appellation of the Paradise of India. The valley is somewhat of an oval form, and is encompassed by hills. Wheat, barley, and other kinds of grain, are cultivated in the more elevated districts; hemp and saffron are abundant; and the grape, from which a white wine is made, thrives well in warm situations. Some of the finer kinds of fruits are produced.

Among the domestic animals, the sheep of this province have been long celebrated for the excellence of their wool. The famous shawls of Cashmere are composed partly of the wool of the sheep and partly of that of the camel. As shawls of this fabric composed a considerable branch of trade, it is said that 40,000 looms were at one time employed in their manufacture.

This district was celebrated in an early period of its history for the learning of its brahmins; afterwards came under the Mahometan dominion; was long subject to a race of Tartar princes; was subdued by Acbar, and afterwards became a province of the Afghan empire.

Cashmere, the capital of the province, stands on the banks of the river Chelum, over which are numerous wooden bridges. The houses are built of brick, connected with wooden frames, and some of them are of considerable height; but the streets are narrow and confined, and covered with filth of all kinds. The vicinity of the place is adorned with fine gardens; and the mosques and pagodas, erected on small hills, form a picturesque scene.

CASPIAN SEA, an extensive inland sea of salt water in Asia, which is bounded by the province of Astracan and Caucasus on the north, and on the other sides by the provinces of Persia, is about 680 miles in length, and varies from 100 to 260 miles in breadth, and included between the 37° and 47° of north latitude. The extent of this expanse of water is supposed to be greatly diminished from its ancient limits. Towards the north and west, the shores of the Caspian are low, flat, and swampy, the water is shallow, and navigation is consequently difficult and dangerous; but other parts of its shores are bold and precipitous, with deep water.

The different ports of the Caspian sea belong to the Russians, the Persians, and the Tartars. The vessels which navigate its waters draw only about 9 or 10 feet of water, and are rudely constructed and unskilfully managed. The Caspian is peculiarly subject to violent storms. Several large rivers discharge their waters into this inland sea, as the Ural and the Volga from the north, and the Kuma, Terek, and some others from the west.

The fisheries of the Caspian present a valuable source of revenue to the different nations which inhabit its shores. The salmon and herrings are excellent. Different species of seals are taken, and the sturgeon, from the roe of which the caviare is made, well known as a commercial commodity from these regions, is abundant. Isinglass is obtained from the same fish. The commerce of the Caspian is very considerable, and extends, by means of canal and river navigation, throughout the Russian empire and the Baltic. The Russians keep several ships of war on this sea.

CASSADA or CASSADA BREAD, a peculiar kind of bread of a very nutritious quality, which is prepared from the root of the *Jatropha manihot*. See BOTANY.

CASSEL, a town in the circle of the upper Rhine, and capital of the landgravate of Hesse Cassel in Germany, stands on the banks of the river Fulda, by which it is traversed, and divided into the old and new town, of which the former covers the largest space; but the streets are narrow and irregular, and the houses are chiefly constructed of wood. In some parts of the new town the streets are spacious and the houses elegant. The principal public buildings are magnificent structures. Fine gardens and beautiful walks adorn the neighbourhood. The population exceeds 20,000; and woollen stuffs, silk and woollen stockings, gold and silver lace, hats, ribbons, delft ware, and porcelain, are enumerated among the manufactures.

CASSINI, JOHN DOMINIQUE, a celebrated astronomer, who was born in Piedmont in 1625. He studied in the Jesuit's college at Genoa; and having read some books on judicial astrology, his attention was directed to make observations on the heavenly bodies, and, from their aspects, had actually begun to predict future events; but in a short time he fortunately withdrew from these idle dreams, and proceeded in the more solid path of useful science. In his 25th year, he was nominated professor of astronomy at Bologna, and he continued to discharge the duties of that situation for several years, while his leisure hours were devoted to promote and improve the science which he taught. During his residence in Bologna, he constructed the famous meridian line in the church of St Petronius, which he examined 40 years afterwards, and found that it had not varied.

The reputation which he had acquired by his observations and works on astronomy, procured for him an invitation from Louis XIV. of France, to become a member of the French academy. Cassini declined the offer, till he obtained the approbation and consent of the Pope and the senate of Bologna, with permission to be absent six years. On his arrival in France in 1669, he was appointed astronomer royal. He continued in France during the remainder of his life, which was laboriously employed during the long period of 41 years in astronomical observations, the results of which appeared in the Transactions of the Academy. During the last years of his life he had the misfortune to be deprived of his eyesight; and he died in 1712, when he had reached the 87th year of his age.

CASSINI, JAMES, was also an eminent astronomer, and youngest son of the preceding, was born at Paris in 1677, acquired great reputation as a mathematician at the early age of 15, and while in his 17th year he was admitted a member of the academy of sciences. In 1696, during a visit to England, he became acquainted with Newton, Halley, and other distinguished geometers. In 1712, he succeeded his father in the royal observatory of Paris, and few years of his life afterwards elapsed without the production of some work on astronomy, or other subjects connected with physics. His researches were particularly directed to the method of determining the longitude of places by the eclipses of the fixed stars and planets, by the moon, the magnitude and distance from the earth of the fixed stars, and the magnitude and figure of the earth. In 1740, he published *Elements of Astronomy*, accompanied with tables. In consequence of a fall from a carriage, he died in 1756.

CASSINI, DE THURE CÆSAR FRANCOIS, the third in succession of the same family who were distinguished as astronomers, was the second son of James Cassini, and was born at Paris in 1719. To the celebrated mathematicians, Maraldi and Camus, he was indebted for his elementary knowledge of geometry and astronomy; and, like his illustrious relatives and predecessors, he gave early indications of great talents for physical researches; for in his tenth year he calculated the phases of the eclipse of the sun that took place in 1727. In the construction of a general chart of France, he was charged with making the requisite preliminary survey, of which an account was published in the Memoirs of the Academy for 1744. During the war in Flanders, he collected materials for the construction of a similar chart of that country; and twenty years afterwards, in consequence of an invitation from the emperor of Germany, he continued the survey to Vienna. Extending his plan, Cassini proposed to connect the British isles with the general chart of France, a project which has been many years in progress. He made additions to the astronomical tables of his father, published three almanacks in the year 1770, and was the author of 70 papers in the Memoirs of the Academy, all of which are connected with astronomy. He was seized with the small pox, and died in September 1784, when he had reached the 71st year of his age.

CASTALIO, SEBASTIAN, a learned French writer, was born at Chatillon, on the banks of the Rhone, in 1515. He enjoyed the intimacy and friendship of Calvin about the year 1540, during his residence at Strasburgh; and through the recommendation of that divine, he was promoted to a professorship at Geneva. Some diversity of opinion in theological matters, made it necessary for him to resign his situation at the end of three years, and returning to Basle he was appointed professor of Greek. He died in 1564. Castalio is best known as the author of an elegant translation of the Bible in classical Latin, which was printed at Basle in 1551, and was dedicated to Edward VI. of England. He also translated the Scriptures into the French language, and was the author of four books of dialogues, in which the principal histories of the Bible are detailed.

CASTILE, two extensive provinces, or former kingdoms of Spain, distinguished by the appellations of *Old* and *New*.

OLD CASTILE is of a very irregular triangular form, of which the longest side is on the west, where it is separated from Leon by the mountains of Guadarama, with the provinces of Asturias and Biscay on the north, Arragon and part of Navarre on the east, and New Castile on the south. The extent of this province is estimated at 18,272 square miles.

In its *general aspect* it is rather flat, though surrounded, and in some places intersected, by mountains of considerable elevation. These mountains are ramifications from the Pyrenean chain, though they are

Castile.

distinguished by particular names, as the Guadarama, the Sierra d'Occa, the Sierra de Gogollos, and the Sierra Piquera. Its principal lakes are those of San Vicente and Santa Casilda. It abounds with rivers, having, besides the large streams of the Douro and Ebro, which pass through it, above twenty tributaries, distinguished by particular names. Hence there is less occasion for canals in this province, and indeed there is only one, which was begun in 1753, and has never been completed.

The soil of Old Castile is in general rocky, but in some parts of the province so rich and humid, as, notwithstanding the heat and dryness of the climate, to be capable of producing luxuriant crops.

Natural history.—The mineral productions are of considerable value. Besides mines of copper and iron, there are traces of gold about two leagues from the mountains of Guadarama. A fine black veined marble composes great part of a mountain between Aspietia and Vidana, and jet is found near old Colemar. A beautiful transparent quartz forms a narrow bed of near half a league in extent, in the neighbourhood of Mata; and there are several salt springs, especially one forming a small lake at the summit of mount Arandillo, where also are found fine specimens of the petrifactions called Ammonites, or *cornua ammonis*, in a bed of limestone. There are numerous mineral waters and some tepid springs. The province is not remarkable for its vegetable productions. Wood is scarce, and is confined chiefly to the banks of the rivers; though in some places there are fine plantations of poplar, elm, and chesnut, and a few districts furnish luxuriant vintages. Among the animals, the most remarkable are the cattle, sheep, and mules. The flocks are numerous, and produce wool of the finest quality; and such is the goodness of the cows and the quality of the pastures, that vast quantities of butter might be produced in this province. Bears and wolves are found in the mountainous parts.

Population.—This province was formerly extremely populous; but at present the number of its inhabitants appears not to exceed 1,200,000, of whom about 146,000 rank among the nobility of Spain.

Divisions.—Old Castile is subdivided into the districts of Burgos on the north, Segovia on the south-east, and Avila on the south-west. The number of parishes in the whole province is 4,555. The principal towns are Burgos the capital, Osmar, Avila, Valladolid, Segovia, Calahorra, and Soria, which have the rank of cities, and Sogiono, Santo Domingo, De la Calzada, Granou, and Acofra. These we shall now briefly describe.

Burgos is situated on the right bank of the river Arlançon, having suburbs on the opposite bank, connected with the city by three stone bridges. It is the seat of an archbishop, and was formerly very populous, though the present number of its inhabitants scarcely amounts to 9000. It is surrounded with a high wall, whose foundations on one side are washed by the river. Its streets are narrow and crooked, and there is only one square deserving particular notice, where the houses are of genteel appearance, and have piazzas before them. The public buildings consist chiefly of the cathedral, an excellent specimen of Gothic architecture, enriched by valuable paintings, the convent of Las Huelgas, the monastery of Augustines, famous for an ancient crucifix, the palace of Velasco, the hotel de Ville, the hospital del Rai, and a triumphal arch raised to the memory of Fernando Gonzales, first count of Castile. Considerable remains of the old castle, a place of great strength, still exist. It contains about 9000 persons. Almost the only manufacture is that of fine woollen stockings, and the chief trade of the city consists in the exportation of fine woollen cloths. There are here a college for the education of young men, and an academy; and an unsuccessful attempt has been made to establish a surgical school. This city is 112 miles N. of Madrid, and lies in W. Long. 3° 38′, and N. Lat. 42° 10′.

Osmar, though formerly an episcopal city, is now in such a depressed condition as scarcely to deserve the name of a town. It is situated on the Douro, about 80 miles N. E. of Madrid, in W. Long. 2° 12′, and N. Lat. 41° 30′.

Avila, is also an episcopal city, situated in an extensive and fertile plain, on the banks of the river Adaja, is surrounded with a strong wall 9075 feet in circumference. It is well built, is adorned with a handsome cathedral and a college, and has a manufacture of excellent broad cloth. It is 40 miles N. W. of Madrid, and in W. Long. 4° 35′, and N. Lat. 40° 45′

Valladolid is one of the chief cities of Spain, a bishop's see, and the seat of a university. It is seated between two small rivers, near their confluence with the Douro, is encompassed with walls, and is well and regularly built, containing several handsome streets, and elegant squares. Among the public buildings are the cathedral, the college, the royal palace, the Dominican church, and not fewer than 70 monasteries or convents, with numerous churches and chapels. One of the seven Spanish courts of judicature is held at Valladolid. Population about 20,000. It has manufactures of woollen cloths, and an academy for drawing and mathematics. It is surrounded with vineyards, orchards, and corn fields. It is 95 miles N. W. of Madrid, and 52 S. W. of Burgos, in 4° 25′ W. Long. and 41° 51′ N. Lat.

Segovia is built on two hills and an intermediate valley, near the river Alrayadda, and is surrounded by a strong wall flanked with towers and ramparts. It is a bishop's see, and was once the seat of government of the Gothic kings. It is one of the most populous cities of Spain, and is adorned by numerous fine buildings, especially the Alcazar, or royal castle, the cathedral, having a great altar decorated with the finest Granada marble, and containing a massy silver statue of the Virgin, the royal chapel, the mint, and one of the finest and most perfect specimens of Roman architecture; an aquæduct, 3000 paces in length, and supported by 177 lofty arches, by which the city is supplied with water. Population about 10,000. Segovia has a manufacture of the finest Spanish cloths, and another of fine paper. There is here a military school for the instruction of artillery officers. It is 45 miles N. W. of Madrid, W. Long. 3° 44′, N. Lat. 40° 57′.

Calahorra, is a bishop's see, and is placed on the

Castile. side of a hill, extending to the Ebro, 70 miles E. of Burgos. W. Long. 2° 7′, N. Lat. 42° 12′.

Soria is also an episcopal town, built near the source of the Douro, 74 miles S. E. of Burgos. W. Long. 2° 2′, N. Lat. 41° 48′.

In Old Castile agriculture is at a very low ebb. The peasants are naturally indolent, and, from the badness of the roads, there is considerable difficulty in disposing of the superabundant produce. There is much wine produced, but it is very inferior to that of other provinces. A considerable quantity of madder is cultivated and prepared for the use of the dyer. The principal manufactures of this province are woollen and linen cloths, paper, leather, and glass; but much of its wool is exported to France. Its principal imports consist of almonds, figs, rice, needles, brass nails, oil, flax, hemp, worsted stockings, and saffron.

The inhabitants of Old Castile are characterised as grave, silent, and unsociable, but honest, obliging, and disinterested.

The monarchy of Spain commenced in this province. The Castilians, in the beginning of the 10th century, revolted from the tyranny of Orduno, king of Leon, to whom they were first subject, and formed themselves into an independent state under the count Gonzalez. His great grand-daughter having married Sancho, king of Navarre, united this province to his kingdom, and in consequence Sancho assumed the title of king of Castile, in 1028. Old Castile long continued the chief province of Spain, till Charles V by transferring the seat of government to Madrid, obliged it to give place to its sister province.

New Castile, the largest province in Spain, is bounded on the north by Old Castile, on the east by Arragon and Valencia, on the south by Murcia and Andalusia, from which it is separated by the mountains of Sierra Morena, and on the west by Estremadura, and part of Leon. Its superficial extent is estimated at about 22,000 square miles.

The general appearance of this province is beautifully diversified by hills and plains, the latter being well watered by rivers, and intersected or surrounded by mountainous ridges, of which the chief are those of Guadaloupe and La Sarena, on the side of Leon, the Sierra de Cuença towards the east, supposed to be the highest land in Spain, the Sierra de Molina, D'Albarazin, and de Guadarama, which last forms its northern boundary. Its lakes are of more importance than those of Old Castile, but still not numerous. The principal are Tobar and Beteta, upon mount Barbaxeda. The chief rivers are the Tagus, the Iaco, and Guadiana, which are navigable, and the Guadarama, the Molina, the Manzanares, and the Moscas, with numerous other smaller streams.

New Castile is remarkably bare of wood. The soil is thin but extremely fertile, and capable of producing most abundant crops, especially as the climate is warm and serene.

Natural History.—Few parts of Spain abound more in mineral riches, though metallic ores are rare. The chief minerals are, marble of various colours, rock salt, and some coal, especially on mount Barbaxeda, where also there is a copper mine. A large emerald has been found at the foot of the Guadarama, and fossil shells are common near Maranchon. There are several mineral waters, both hot and cold; and in the Sierra de Cuença are some extraordinary caves. Among its vegetable productions may be enumerated the olive, the pine, several species of oak, especially one on which the insect used in dyeing is found, the poplar, the elm, and the crocus from which saffron is made. The animals are similar to those of Old Castile, but the lynx and the ibex are occasionally seen in the mountains of Cuença. The lakes abound with tench and other fresh water fish, and are frequented by numerous flocks of water-fowl, especially teal and wild ducks.

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Population.—This province is not even so populous as Old Castile. Laborde estimates the number of inhabitants at 1,146,809, of whom 12,687 belong to the nobility.

Divisions.—This province, like the former, has three subdivisions. Toledo on the west, Cuença on the east, and La Mancha on the south. There are in this province 1,301 parishes, 375 religious houses, 116 hospitals, three universities, 50 schools, six cities, and 754 towns. The chief places are Madrid, Toledo, Cuença, Ocana, Talavera de la Reyna, Alcala de Henarez, Laguardia, Tarragona, Aranjuez, Guadalaxara, Seguenza, and Ciudad Real.

Madrid—though now the capital of Spain, was formerly a small and insignificant town. It is built in an extensive plain on the banks of the small river Manzanares; but as it has low walls and no proper suburbs, the approach to it is known only by its numerous towers and steeples. Over the river are two large and handsome bridges, but the stream is so shallow as in general to be easily forded by horses and carriages. The interior of the city has a handsome appearance, as the streets are straight and spacious, and the houses pretty regular, and frequently ornamented with balconies and piazzas, though built only of brick. There are 42 squares, but they are not regular. In one of the largest and most uniform is held the public market, and in the same place are exhibited those barbarous spectacles called bull-fights. Most of the streets and squares are adorned with fountains. The city has fifteen gates, and two of these form the extremities of a spacious and fashionable walk, called the *prado*, constituting the general promenade for all ranks of the inhabitants. The principal public buildings in Madrid are, the palace, standing on an eminence of a superb appearance, and possessing a considerable collection of paintings of the Spanish school; the royal residence of Bueno Retiro; and the armeria, or arsenal, containing a great variety of ancient and foreign warlike weapons. There are 35 monasteries, 31 nunneries, and 39 colleges, besides hospitals, or other charitable institutions. There are also four literary academics, and a royal library. This city contains 18 parishes, between 7 and 8000 houses, and about 146,000 inhabitants. The streets are remarkably clean and well lighted. The manners and dress of the citizens have something peculiar. The men wear cocked hats, and smoke segars in the streets, and, for their accommodation, boys are continually running about with burning torches. The ladies wear half veils, and are affable and unaffected without being immodest. This city lies in W. Long. 3° 12′, and N. Lat. 40° 25′.

Toledo is situated in a narrow valley, surrounded by lofty mountains, on the banks of the Tagus. It is built on the sides and top of a rock of granite, and is entered by a bridge of considerable height. Its general appearance is unpleasant, the streets being narrow, crooked, and uneven. It is an archbishop's see, and has an elegant cathedral, a superb alcazar, or palace, with numerous churches, a neat town house, an archiepiscopal palace, and several hospitals. There are four gates, two bridges, and two public walks. It contains about 20,000 inhabitants, and is remarkable for its manufacture of sword-blades of exquisite temper. There are also made here a few woollen stockings, but its other manufactures have fallen into decay. Toledo is a city of great antiquity, and has successively been the seat of empire to the Gothic, Moorish, and Castilian kings. It is 37 miles south of Madrid, in W. Long. 3° 20′ and N. Lat. 39° 53′.

Cuença, the seat of a bishoprick, and the capital of the sierra of that name, is situated on an eminence between two more elevated ridges, and is surrounded by walls of an extraordinary height, with six gates. The streets are uneven, and so steep as not to be ascended without difficulty, and sometimes danger. It has a noble Gothic cathedral, an episcopal palace, 12 monasteries, several churches, with gates of remarkable workmanship, and a magnificent bridge over the Huecar. It is supposed to contain 6000 inhabitants, has a seminary, and three colleges, three hospitals, and is divided into 13 parishes. It has a small woollen manufactory, and large quantities of wax and honey are produced in its neighbourhood. It is 74 miles E. by S. of Madrid, in W. Long. 1° 55′, N. Lat. 40° 7′.

Ocana, in La Mancha, is a large town, occupying the entrance of an extensive plain, and contains four parishes, six monasteries, and five convents, and has two public fountains. It was once a large manufacturing town, but there is now only one manufactory of coarse leather and four of hard soap. It is 18 miles east of Toledo, in W. Long. 2° 50′, N. Lat. 39° 52′.

Talavera de la Reyna, an ancient city on the right bank of the Tagus, surrounded with walls, and fortified with turrets and ramparts; is of considerable extent, and stands in a beautiful, well cultivated plain; has a bridge over the Tagus, nine gates, and one large square; but the streets are narrow, and the houses extremely low. It has few edifices deserving notice, and these consist principally of churches. The condition of this place has been much improved by the introduction of numerous manufactures of silk stuffs, soap, hats, porcelain, and gilded articles. Talavera is now remarkable as having been the seat of a great battle fought between the French and combined forces of Britain and Spain, on the 27th July 1809. It is 58 miles S. W. of Madrid. W. Long. 4° 1′, N. Lat. 39° 41′.

Aranjuez, a small but beautiful town on the left bank of the Tagus, remarkable chiefly as being the summer residence of the royal family. It is regularly built, has good streets, some of which are planted with trees, an elegant square, several public edifices, among which are the royal palace, distinguished by neatness rather than elegance, many beautiful walks and fountains, and the environs are laid out in gardens. It is 20 miles nearly south of Madrid.

Guadalaxara is an ancient city, large, but ill built, situated in a plain near the eastern bank of the Henarez, and containing a population of about 12,000 people. It has ten parishes, six monasteries, seven convents, and two hospitals; and among the public buildings, the most deserving of notice is the palace of the noble family of Infantado, built in the form of a pantheon. Here is an extensive manufactory of woollen cloths and serges. It is 30 miles N. E. of Madrid. W. Long. 2° 47′, N. Lat. 40° 36′.

Seguenza, unaccountably placed by Laborde in Old Castile, is an archiepiscopal town, and the seat of a university, situated on a small river that runs into the Henares. It is well built, and fortified with a strong wall. It has a castle and a cathedral. It has a manufactory of calicoes. It is 60 miles N. E. of Madrid. W. Long. 2° 41′, N. Lat. 41° 6′.

Ciudad Real, considered as the capital of La Mancha, is situated in a plain not far from the Guadiana. It is regularly built, has a handsome square, and a manufactory of flannels and coarse woollen cloths. Population between 8 and 9,000. It is the residence of the intendant of La Mancha, and of the grand vicar of the archbishop of Toledo. It is 90 miles south of Madrid; in W. Long. 3° 25′, and N. Lat. 38° 58′.

In the neighbourhood of Madrid is the royal palace of the Escurial, and some miles farther to the north the royal residence of St Ildefonso.

Agriculture.—New Castile is scarcely more advanced in respect of agriculture than the neighbouring province. Some wheat and barley are cultivated, and a considerable quantity of wine is produced, though of inferior quality; but, in general, the land is much neglected, and the practice of irrigation, of which the soil has much need, is scarcely known. Great quantities of wax and honey are collected, and excellent oil might be prepared if sufficient care were taken in its expression.

Manufactures, commerce, &c.—The chief manufactures of New Castile have been noticed in the above description of its towns. Its exports are few, and its imports consist chiefly of articles of luxury. The roads are greatly improved, and much superior to those of Old Castile. If we except the capital, the inhabitants of New Castile are indolent and inactive, haughty and reserved, and remarkable for their ignorance both of literature and the arts.

This province was occupied by the Romans previous to the 5th century, when it was wrested from them by the Gothic chief Altholphus, who fixed his residence at Toledo. It continued under the dominion of the Goths till the fall of Roderigo in the begining of the 8th century, when it became subject to the Moors. It was finally united to the Spanish monarchy in the 11th century.

CASTLETOWN, a town of Derbyshire in England.

CASTLETOWN, the capital of the isle of Man. See MAN, ISLE OF.

CASTS, OR CASTES, is the appellation of the four great tribes into which the native inhabitants of

India have been divided from the remotest periods of antiquity. The first cast is that of the Brahmins, and is accounted the most sacred, and those belonging to this cast are the priests and philosophers of the country. The government and defence of the state are entrusted to those of the second cast or tribe, called *Ketri* in the native language. From this cast are selected the magistrates and rulers of the nation, the generals and soldiers of the army. The third tribe or cast, called *Byse*, includes the husbandmen and merchants; and under the fourth, denominated *Sudra*, are comprehended the artizans, labourers, and servants. Flagrant misconduct, as the violation or neglect of religious duties, subjects the guilty person to a kind of excommunication from all intercourse with his tribe. The *Pariars*, the appellation of such excommunicated persons, are reduced to a wretched condition. In some parts of India, if a pariar approach a warrior of high cast, the latter may put him to death with impunity. Even the shadow of those vile beings passing over what is to be used for meat or drink, is supposed to defile it. Of these casts, the Sudra, or artizans and servants, are the most numerous; and the three higher casts are supposed to amount to no more than a fifth part of the whole population. According to the institution of Hindoo society, the same family and all its descendants are bound to follow the same professional employment; and hence arises the great perfection which mechanical operations in different arts have reached in India. But this limitation to particular trades and professions is now less scrupulously observed, particularly in those parts of the East which are under the jurisdiction of a foreign government, and persons belonging to a higher cast are found exercising the menial offices of the lowest.

CATS-EYE, a gem or precious stone belonging to the siliceous genus of minerals. See GEOLOGY.

CATACOMB, a subterraneous gallery or chamber for the reception of the dead. From the natural anxiety which exists in the human mind for the disposal of the bodies of departed friends, places of this kind have been constructed by different nations. In ruder periods of society, the bodies of the dead were deposited in natural caves; but when such were wanting, artificial excavations were made. The most ancient and the most celebrated catacombs are those of the Theban kings, which are known to have existed for more than 3000 years. The chain of mountains in the vicinity of Thebes is excavated to nearly three-fourths of their height, and includes a prodigious number of entrances, which lead to an almost endless number of catacombs. The walls, throughout their whole extent are covered with paintings and hieroglyphics, which still exhibit all the freshness of the original colours. Some of these catacombs are particularly described by the French travellers who attended the army of Bonaparte during his invasion of Egypt; but it appears that these depositaries of the dead have been long ago violated, and all the bodies have been carried off.

The catacombs of Rome are also long subterraneous galleries intersecting each other at right angles, or going off in an oblique direction. By openings from above, a feeble glimmering of light is admitted, and on each side are seen cavities which are supposed to have been destined for lamps. The bodies were disposed in niches formed in the walls, and they were arranged in regular rows above each other. Each niche was closed at the foot with a single brick, and the cement with which it is secured is yet seen in good condition; and when some of these bricks which closed the tomb were removed, the skeletons were found nearly entire.

Catacombs have been found in other parts of the world, as at Syracuse, where the excavation forms regular parallel recesses and chambers, with a flat circular roof, and an opening at the top for the admission of light; at Malta, where they are cut in the rock with small narrow galleries; and in Syria and Palestine, to which a large flat stone, moved on pivots for hinges, forms the door.

From the belief which prevailed among the Egyptians, that the soul would be reunited to the body, if the latter were preserved entire, it is supposed the practice of embalming and the use of other means to secure it from decay have originated. But the catacombs have not been solely confined to the reception of the bodies of men. Mummies have been made, by the ancient Egyptians, of the bodies of various animals, as jackals, crocodiles, birds, and fishes, and have been consigned to these repositories of the dead. In particular, the ibis, or sacred bird of the Egyptians, is found in great preservation, and exhibiting the rich colours of its plumage.

CATALONIA, a province of Spain, occupying the north-east angle of that peninsula. It is bounded on the north by the Pyrenean mountains, which separate it from France; on the east and south-east by the Mediterranean; on the west by the province of Arragon; and on the south-west by that of Valencia. Its extent in square miles is estimated at 10,400.

General aspect.—The general appearance of this province is irregular and mountainous, having, however, several rich and fertile plains and vallies, watered by numerous rivers. Wood is here more plentiful than in many other provinces in Spain. The mountains of Catalonia are ramifications of the Pyrenees. The principal are those of Montserrat, rising about 3300 feet above the level of the sea, and remarkable for its lofty, rugged, and naked cliffs, Mon-Negre, Valgorguina, Sangran, Alsinellas, Requesens, and Monseny. Among the numerous rivers which flow through this province may be particularised the Ebro, the Lobregat, the Ter, the Noya, and the Cervera. Of these the Ebro is the largest and most navigable, disemboguing itself into the Mediterranean, near the south-western extremity of the province. Catalonia has numerous canals, but these serve rather for watering the fields than for the purposes of navigation.

The soil is generally thin and rocky, and in some parts so scanty as to require a considerable addition brought from other places. The climate is keen and healthy.

Natural history.—A great quantity of mineral productions occur in Catalonia. There are mines of iron, lead, copper, tin, antimony, and silver, and even one of gold. Coal and salt are very common, and in particular there is a considerable mountain in the neighbourhood of Cardona, composed entirely of salt. Marble of various kinds is very common, and near Vray are found amethysts and topazes. Nor is this province less rich in vegetables. Trees of most kinds, especially evergreens, are found in tolerable abundance, and not fewer than 437 species of plants are enumerated as found on the mountain of Montserrat; the vine and the olive grow well, and nuts and other fruits are produced in great quantity. The mules of Catalonia are remarkable for their strength and the security with which they traverse the mountainous districts. Bears and wolves are not uncommon in the higher regions.

Population.—The total number of inhabitants of this province is computed at 814,412, and of this number 1266 are nobles.

Divisions.—There are two subdivisions of Catalonia, denominated the counties of Roussillon and Cerdagne. The province comprehends an archbishoprick, 7 bishopricks, 22 abbeys, enjoying nearly episcopal privileges, one grand priory, 2,738 parishes, a university, 14 cities, and 283 towns, of which five are seaports. Barcelona, the capital, has been already described under its proper name. The following towns are most deserving of notice, viz.

Tarragona—the seat of an archbishop, is a place of considerable importance, chiefly on account of its antiquity. It is built near the small river Francoli, near the place where it falls into the sea, upon a very elevated rocky ground. It is surrounded with walls, and has a harbour flanked with bastions. Its streets are narrow, crooked, and irregular, without squares, but it has several handsome edifices. The cathedral is an elegant Gothic structure, with numerous internal ornaments. There are several neat chapels, and two castles of little importance. This city is extremely deficient in the necessary article of water, there being neither wells nor fountains, so that the inhabitants are supplied partly from rain water kept in cisterns, and partly from distant springs by means of an aquæduct. There are several remains of Roman architecture, especially the walls built by Scipio, the aquæduct, nearly seven leagues long, a palace, a temple, and an amphitheatre. It contains about 9000 inhabitants. There are here considerable manufactures of silk and cotton goods, and the wine produced in its neighbourhood is of excellent quality. Tarragona was the seat of government of the Roman Tarragonese province. It is 220 miles N. E. from Madrid, and lies in E. Long. 1° 13′, and N. Lat. 41° 51′.

Urgel—a bishop's see, and formerly capital of a province of the same name, is situated in a fertile plain near the river Segra, 75 miles N. W. of Barcelona, in E. Long. 1° 44′, and N. Lat. 42° 32′.

Lerida—a bishop's see, and the seat of a university, one of the most ancient cities in Spain, is built on a rising ground on the banks of the Segra. It contains about 18,000 inhabitants. Here several important battles have been fought, both in ancient and modern times, particularly between Scipio and Hanno during the Punic wars, and between Julius Cæsar and the armies of Pompey. It has a fine bridge over the Segra, and its environs are highly interesting. It is 200 miles N. E. of Madrid, in E. Long. 45′, and N. Lat. 41° 44′.

Gerona—an episcopal city built on the side of a mountain on both banks of the river Ter. Its chief public buildings are the cathedral and collegiate church. It contains about 14,000 inhabitants, and is also a place of great antiquity. It is a fortified place, and has sustained several sieges. Its chief manufactures are those of cotton stuffs and worsted stockings. It has a college, generally frequented by about 900 students, and several institutions for the education of females. It is about 16 Spanish leagues from Barcelona.

Tortosa—a bishoprick and university, is built on a fertile plain on the banks of the Ebro; it has strong walls, and a large but ruinous castle. The cathedral is an elegant building, with the usual ornaments of Catholic churches, and there are several religious houses and public hospitals. Its manufactures are of some importance, and consist chiefly of hard and soft soap and common porcelain. This city was also a Roman station, and was called Dordosa. It is 180 miles E. of Madrid, in E. Long. 35′, and N. Lat. 40° 53′.

Figueras—a small but strongly fortified town, situa- in an extensive plain near the confines of France. It contains about 4000 inhabitants. It is remarkable for a very strong castle, deemed nearly impregnable. E. Long. 2° 46′, N. Lat. 42° 18′.

Igualda—a town of considerable size, surrounded by vineyards, corn-fields, and plantations of olives. It contains about 12,000 inhabitants, and is remarkable chiefly for its manufactures of printed calicoes and excellent fire-arms.

Agriculture.—Notwithstanding the natural disadvantages of the soil of Catalonia, there is no part of Spain where agriculture is better understood or more assiduously practised. Corn of every description, even rice, is cultivated with success, though the quantity of wheat is insufficient for the consumption of the inhabitants. The system of irrigation is carried to a greater extent than in most other countries, and the wine and oil of this province are in considerable esteem. Flax and hemp are cultivated successfully, but the production of wool is scanty. Planting is carried on to a great extent, especially that of cork trees, so that the greater part of Europe is hence supplied with that useful article.

Manufactures, commerce, &c.—Most of the manufactures of Catalonia have been noticed above, or with Barcelona. Besides those there enumerated may be mentioned, gunpowder, aquafortis, sugar-of-lead, brandy in large quantities, various articles of cutlery, and anchors. Its commerce is considerable, the exports consisting chiefly of the productions and manufactures already enumerated, and the imports of corn, wool, and silk. The roads of Catalonia are very bad, but good inns are more common than in most other parts of Spain.

The Catalans are blunt, uncourteous, and resentful, but active, brave, industrious, and enterprising, much given to travel, so that they are found in most parts of Spain, and in several foreign countries. They are remarkable for their independent and warlike spirit.

Catalonia was very early colonized by the Carthaginians, from whom it was wrested by the power of Rome. In the subjugation of the Roman empire by the barbarians, this province, with much of the adjacent country, fell a prey to the Goths, who were compelled for a short time to yield it to the Moors. In the latter end of the 8th century it became a province of France, was afterwards erected into an independent state under the counts of Barcelona. In 1137 it was annexed to the crown of Arragon, and has since, with occasional insurrections and revolts, continued to form a part of the Spanish monarchy.

CATANIA, a city of Sicily, near the foot of mount Ætna, which, under the name of *Catina*, made a conspicuous figure in ancient history, and has not been less known in modern times on account of the dreadful calamities to which it has been subjected by the ravages of earthquakes and the eruptions of Ætna. See SICILY.

CATAPULTA, an ancient military engine which was constructed for throwing stones, darts, and other missile weapons upon an enemy; some of which were of such strength that they were capable of projecting stones of a hundred weight.

CATARACT, a disease of the eye, in which the vitreous humour has become opaque, and produced blindness.

CATECHU, an astringent substance, which is extracted from different plants, and was long distinguished by the name of *terra Japonica*, or Japan earth, because it was supposed to be an earth brought from that island. But it is found to contain a large proportion of tannin, with some extractive matter, and mucilage. It is employed in India as a dye-stuff, in the composition of Betel, and as an ointment; and it is applied in Europe chiefly to medical purposes.

CATEGORY, a well known term in scholastic philosophy, and denoting a series or order of all the predicates or attributes included under any class of thoughts or ideas. Aristotle divided all the objects of human thought into ten categories, namely, quantity, quality, relation, action, passion, time, place, situation, and habit; and this arrangement was long followed in the schools.

CATENARIA, or CATENARIAN CURVE, is formed by a rope or chain hanging freely from two points of suspension.

CATERPILLAR, is the appellation of the reptile or worm state of insects. See ENTOMOLOGY.

CATESBEA, the LILY-THORN, a genus of plants belonging to the Tetrandria class.

CATOPTRICS, is that branch of optics which explains the laws and properties of light reflected from plane or curved surfaces. See OPTICS.

CATULLUS, CAIUS VALERIUS, a celebrated Roman poet, was a native of Verona, and flourished in the time of Julius Cæsar, Cicero, and Lucretius the poet. His residence was chiefly at Rome, where he enjoyed the society and pleasures of the capital. The poems of Catullus, which are chiefly elegiac compositions, were in great estimation among his cotemporaries, and they are distinguished by great tenderness and simplicity. But the indelicacy of his language and allusions is justly objected to. Many elaborate editions of his works have issued from the press on the continent; and in Britain an English translation in verse was published in 1795, along with the Latin text, and with illustrative notes.

CAVALLO, TIBERIUS, a natural philosopher, was a native of Naples, and was born in that city, in the year 1749. His father, a physician, died when the son was only in his 11th year, but the care of his friends enabled him to prosecute and finish an academical education. Originally destined to engage in commerce as the future business of his life, he was sent to England in 1771, for the purpose of improving and extending his knowledge of mercantile affairs. That country became his final residence, and the routine of commercial transactions was soon exchanged for the pursuits of literature and the cultivation of science.

The researches of Cavallo were extended to various departments of natural philosophy; but electricity, which at that time excited great attention, was the first object of his enquiries; and the results of his labours were published in three memoirs in the Philosophical Transactions for 1776 and 1777, and in the latter year, *A Complete Treatise on Electricity*, octavo, appeared, in which is detailed a familiar exposition of the principal facts then known, illustrated by experiments. Mr Cavallo published other works connected with the same subject, as well as on the kindred science of magnetism; *A Treatise on the Air and Permanently Elastic Fluids, and the History and Practice of Aerostation.* He wrote also on the *Temperament of Musical Intervals, and on Factitious Airs, and the Nature of the Blood*; and among the last of his labours are his *Elements of Natural or Experimental Philosophy*, in four volumes *octavo*, and published in 1803. This excellent work embraces whatever is valuable in physical science, and illustrates the various subjects, which are discussed in a popular manner. Mr Cavallo died in 1809, when he had reached the 60th year of his age.

CAVAN, an inland county of the province of Ulster, n Ireland, is bounded on the north and east by the counties of Fermanagh and Monaghan, and on the south and west by Meath, Longford, and Leitrim, is about 51 miles long, and 28 miles at its greatest breadth, and includes an area of 758 square miles. The whole surface of the county presents a mountainous aspect. Numerous lakes appear in the central parts of the county, and some are formed by the expansion of the streams which carry off the waters from the lakes of Westmeath.

The soil is described as poor, and agricultural improvements have not made rapid advances. Oats, potatoes, and flax are the most frequent crops; and the farms, chiefly occupied by manufacturers, rarely exceed 20 acres in extent. Linen was formerly the great object which employed the industry of the manufacturers, but it has given place, in some degree, to cotton fabrics. The population is estimated at more than 90,000; and the population of catholics to protestants is five to one. The county consists of 30 parishes; and being forfeited about the commencement of the reign of James I. it was occupied by a colony of English settlers, many of whose descendants still retain possession of the property assigned to their predecessors.

Cavan—the capital of the county, is not of sufficient importance to require minute description. It is a market and post-town, and has the advantage of

Caucasus. a free-school, for the support of which 570 acres of land were appropriated by charter in the time of Charles I.; but it appears from a late survey that some mismanagement has crept in, for few or scarcely any scholars attend it. *Kilmore* is also a small town in the same county.

CAUCASUS, a government of Russia in the southern part of that empire, and is divided into two provinces, namely, Astracan and Caucasus. The province of Caucasus includes the Cuban and all those districts subject to the Russian dominion between the Black sea and the Caspian, and the Don and Cuban rivers.

The mountains of Caucasus constitute the most striking feature of this region; they extend between three and four hundred miles, from the Euxine to the Caspian sea; the highest part of this elevated ridge is covered with perpetual snow; and hence the allusion which has been made to the *frosty Caucasus*, both in ancient and modern times. The higher mountains are composed of primitive rocks; the summits are of granite; slate-rocks, and limestone, or chalk, appear in the lower regions; rock-salt, and other saline matters, sulphur and alum, are disseminated in the plains; some indications of coal are met with, and some ores of iron, copper, and lead, with a little silver and gold, are distributed in the rocks. Various mineral springs have been discovered in these regions, some of which are cold, and composed of saline ingredients, and some of them are hot, and of a sulphureous quality.

On that side of the mountains which is connected with the Russian territory, the Terek, the Kuma, and the Cuban, are the principal rivers. The Terek, deriving its source from the snowy mountains of Caucasus, and from the most elevated parts of the frontiers of Georgia, proceeds with a rapid course; and in the months of July and August is greatly enlarged by the melting of the snows, and inundates the flat country. In the lower part of its course its banks are destitute of wood; but in the higher regions they are adorned with fine forests of oak and other trees; it becomes less rapid below the town of Kislar, and joins the Caspian by several branches, three of which are navigable for boats. In the lower districts through which the Terek flows, the vine, the mulberry, and other fruit-trees, are successfully cultivated.

The Kuma rises in the same mountains, and, directing its course towards the east, traverses a rich valley; but its waters are lost in the sands before it reaches the Caspian. The banks are clothed with shrubs and reeds, which afford a retreat to an immense number of pheasants.

The Cuban is the largest river of this district, and was called *Hypanis* by the Greeks. Its source is in the highest mountain of Caucasus, and it forms the frontier boundary of the Russian empire. It terminates its course by two branches, one of which falls into the sea of Asoph, and the other discharges its waters into the Black sea. In the island of Taman, from the two branches a canal is cut, which joins the sea of Asoph with the Black sea. This river is enlarged by many tributary streams; in the higher parts of its course the banks are steep and rocky, and in the plains it is navigable for flat-bottomed vessels. It abounds with fish of an excellent quality; and the fisheries afford the chief employment to the inhabitants in the neighbourhood.

This government was separated from Astracan in 1801. The number of inhabitants is stated at 31,579 males, which are chiefly Russians; but among them are also Tartars, Armenians, Georgians, and Cossacks, beside Calmucs and other migratory tribes, who frequent the steppes, or extensive flats, for the purpose of pasturage to their numerous herds and flocks. Honey, wax, furs, hides, fruits of different kinds, and wines, which have lately begun to be objects of manufacture, are the principal productions.

Cave. CAVE, Edward, a printer, and projector of the *Gentleman's Magazine*, the first periodical work of the kind in this country, was a native of Warwickshire, and was born in 1691. His father, disappointed in family expectations, was compelled to follow the trade of a shoemaker at Rugby, at the celebrated free-school of which, at that time in high reputation, young Cave was placed, and, by the quickness of his talents, acquired a decided superiority over his fellows, many of whom were connected with families of the highest rank. But this advantage gave him an invidious distinction, and was followed by such harsh and ungenerous treatment, that he determined to leave the school, and resign the hope of a literary education.

After various attempts to acquire some profession, he went to London and bound himself apprentice to a respectable printer. With little comfort in the society of his master and mistress, who lived in unceasing discord, he persevered in acquiring a knowledge of his business, and was so much master of it at the end of two years, that he was intrusted with the superintendence of a printing-house at Norwich, and the publication of a weekly newspaper. Opposition arose as usual to the new undertaking, and produced a public controversy, in which young Cave acquired the reputation of a writer. At the conclusion of his apprenticeship, he continued to work as a journeyman, and having espoused the principles of the Tories, he was for some years a writer in Mist's *Journal*. He afterwards obtained a place in the post-office, but still exercised his trade during the intervals of attendance. The situation which he held in the post-office enabled him to procure country newspapers, the intelligence of which he sold to a London journalist for a guinea a week. He was afterwards promoted to the office of clerk of the franks, in the management of which his spirit and firmness were greatly applauded, for he often stopped franks when the privilege thus enjoyed seemed to be abused. In this exercise of his office complaints arose, and charges of opening letters to detect them were brought against him; and being cited before the house of Commons for a breach of privilege he was at last dismissed from his place. By his diligence and economy, he collected a sum sufficient to set up a printing-office, and began the Gentleman's Magazine, which long continued to be the most popular, as it was the first periodical publication of the kind in this country; and to the success of this undertaking he was indebted for the ample fortune which he left behind him.

"Cave," says Dr Johnson, his biographer, "began to aspire to popularity; and being a greater lover of poetry than any other art, he sometimes offered subjects for poems, and proposed prizes for the best performance. The first prize was L.50, for which, being but newly acquainted with wealth, and thinking the influence of L.50 extremely great, he expected the first authors of the kingdom to appear as competitors, and offered the allotment of the prize to the universities. But when the time came, no name was seen among the writers that had ever been seen before; the universities and several private men rejected the province of assigning the prize. At all this Mr Cave wondered a while, but his natural judgment, and a wider acquaintance with the world, soon cured him of his astonishment, as of many other prejudices and errors. Nor have many men been raised by accident or industry to sudden riches that retained less of the meanness of their former state.

"The death of his wife produced a strong effect on his health; he lost his sleep and his appetite, and having lingered about two years he died in 1754, after he had concluded the 23d annual collection. His resolution and perseverance were very uncommon; in whatever he undertook, neither expence nor fatigue was able to repress him; his constancy was calm, and, to those who did not know him, appeared faint and languid; but he always went forward though he moved slowly." See *Cave's life* by Dr Johnson.

CAVEAT is a term applied to a process in the ecclesiastical courts of England to stop the proving of a will, and the granting of titles of administration to the prejudice of another; and denotes also the preliminary process which is sometimes followed in applying for a patent to secure the privilege of any invention.

CAVIARE, a preparation of the hard roe of the sturgeon, by forming it into cakes three or four inches in breadth, and about an inch in thickness. It is prepared by separating the membranous covering of the roe, washing it in vinegar, and salting and pressing it. It is then put up in small casks, and becomes a valuable commercial commodity throughout Europe. The best caviare is from the Caspian sea.

CAUK or Cawk, a mineral substance, partly composed of heavy spar and partly of carbonate of lime, and distinguished by this provincial name in Derbyshire.

CAYENNE, or French Guiana, a province of South America. See Guiana.

CAYLUS, Count de, Marquis de Sternay, a celebrated French antiquary, was born at Paris in 1692. His early education was the peculiar concern of parental affection. His mother, who was the niece of the famous Madame de Maintenon, and was equally distinguished for vigour of intellect and sprightliness of wit, undertook the charge of improving his heart in the softer virtues, while his father instructed him in corporeal exercises and in the profession of arms. Having entered the army, he was soon distinguished by his valour, and was at last promoted to the command of a regiment of dragoons. When the peace was concluded he was left without employment; and that he might not remain in a state of listless inactivity, he had a strong desire to visit Italy, where he acquired that taste for antiquities, which became his ruling passion through the remaining part of his life.

In another journey, he directed his course to the Levant, visited Smyrna, and examined the ruins of Ephesus. Among his various researches into the arts of the ancients, his most important discovery is the method of executing encaustic painting. He derived the first hint, it is supposed, from the description of Pliny, and, after many experiments, he found out the secret of incorporating wax with various tints and colours, and of making it obedient to the pencil. Such was the progress by which he discovered the composition, and the colouring of the pictures of ancient Rome. A collection of coloured drawings, taken from antique pictures, had fallen into his possession; and before he placed it in the French king's cabinet, he had the whole engraved, and so finely coloured as to rival the vivid tints of the originals. Thirty copies of this work only were published. Another favourite object of pursuit was to engrave the Roman antiquities, which still remain in the southern provinces of France. In this work he was engaged during his last illness. He died in 1765; and his tomb, which is an ancient sepulchral antique of beautiful porphyry, marks the character of its inhabitant.

CEANOTHUS, New Jersey Tea, a genus of plants belonging to the Pentandria class.

CEBES, an ancient Greek philosopher, and a native of Thebes, flourished about 400 years before the Christian era. It is said that he was an intimate friend of Socrates; but he is best known as the author of a work which is distinguished by his name. The table of Cebes, which exhibits a picture of human life, is familiar even to those who have not made great progress in the knowledge of the Greek language.

CECILIA, St. the patroness of music, of whom many legendary stories are related, lived about the beginning of the third century, had been converted to Christianity, and having suffered martyrdom by being thrown into a cauldron of boiling water, her name was enrolled among the list of saints about the fifth century. According to the tradition, she greatly excelled in music, and hence her story has become a favourite subject for the poet and painter.

CECROPS, was the founder and first king of Athens, and is supposed to have flourished about the time of Moses. He introduced many improvements into the domestic policy of the Greeks, over whom he reigned during the long period of 50 years.

CEDAR, the English name of several species of trees which belong to different genera; but the true cedar, or cedar of Lebanon, alluded to in Scripture history, is a species of pine, *pinus cedrus*, which becomes a lofty tree.

CELEBES, an island in the Indian ocean, of a very irregular form, and separated from Borneo by the straits of Macassar, extending from the 2° of north latitude to nearly the 6° of south latitude, and stated to be about 500 miles in length, and 150 miles in breadth. The coast is deeply indented by three bays, or gulfs, the first of which, called Buggess bay, runs into the island from the southward; another deep gulf penetrates the north-east quarter of the island; and the third, called Tolla bay, is in the eastern district. Three rivers, some of which are of considerable magnitude, traverse the different quarters of the island. The Chinrana, which is the largest, discharges its waters by several mouths into Buggess bay, and is navigable for European ships.

The principal productions of the island are rice and cotton. The latter is manufactured into cloth called Cambays, some of which are of a very fine fabric. Some kinds of silk stuffs are also manufactured, with fire-arms, small brass guns, and works in gold and silver. Prows, or boats of a light construction, are built in the island. In these prows they have commercial intercourse with most places in the eastern ocean. They are often seen on the northern coast of New Holland, where they fish sea-swallo for the Chinese market. Gold collected from the beds of rivers and torrents, at one time in considerable quantity, was exchanged for opium and different fabrics of cloth from Bengal; iron and steel, cotton and rice, are also exported.

The Buggesses, as they are called by the English, and who are the most powerful nation in the island, and the Macassars, are the best known to Europeans of the various tribes which inhabit Celebes. The Portuguese early obtained a settlement near Macassar. They were expelled by the Dutch in 1660. The authority of the latter had been long on the decline, and it finally terminated in 1812, by the reduction of Macassar and Fort Rotterdam by the British forces.

Macassar, the principal settlement of the Dutch, stands on the south-west coast of the island, and is defended by Fort Rotterdam, the walls of which are strong, and constructed of stone. The town lies in an extentive plain, which stretches to the foot of a mountainous range to the eastward. This plain is covered with rice fields and pasture grounds, and is watered by small canals proceeding from the larger springs that descend from the mountains. According to some accounts, the population of Macassar is is stated at 10,000. Rice, sapan-wood, and cadjany are the chief exports from this place; and by a Chinese junk, which arrives annually, nankeens, silk goods, sugar, tea, China-ware, and some other commodities, are imported.

CELLINI, Benvenuto, an eminent Italian statuary and sculptor, was born at Florence in the year 1500. His taste led him to imitate the celebrated productions of antiquity, and in that style, at a very early age, he executed some works in gold and silver, which were greatly admired. He was first employed in seal engraving, cutting dies, modelling, and enamelling. In a war between the French and the head of the church, when the former invaded and captured Rome, Cellini took up arms and signalised himself by his skill and prowess in the defence of the city. He afterwards held the place of stamp-master to the mint, and some other lucrative offices under the pope. But from the violence and ferocity of his temper he was frequently concerned in fatal broils, and in these affrays he killed several persons, from the consequences of which he escaped by temporary retirement, and the exercise of the dispensing power of the pope. Dissatisfied with the patronage which he received from his holiness, he relinquished his service for some time, and travelled in the retinue of Francis I. Here, too, he seems to have been disappointed in his expectations; for he returned to Rome, and was immediately seized and thrown into confinement, on a charge of having purloined some of the jewels of the papal regalia. In attempting to escape from a lofty tower of the castle of St Angelo, he fell from a rampart and broke his leg; after his recovery he was subjected to a still more rigorous imprisonment in a loathsome dungeon; and it was only through the mediation of Francis I. that he obtained his liberation.

Repairing to France, he engaged assiduously in the exercise of his art, and he produced silver statues of some of the heathen gods and goddesses, which procured for the artist the greatest admiration, as well as a liberal pension, and other honours, from the king. But his good fortune again left him, and he returned to Italy, where he was taken into the service of Cosmo di Medici, grand duke of Tuscany; and at the desire of his patron he undertook to cast a statue of Perseus in bronze. In the execution of this great work he laboured with all his ingenuity; but when it was examined part of the right foot was found defective. When this superb production was exhibited to public view, it was beheld by all ranks with the highest admiration, and sonnets and epigrams, celebrating his praises, were addressed to the artist.

Cellini died in the year 1570; and as a mark of respect for his distinguished talents, his funeral obsequies were attended by all the members of the Florentine academy. As an artist he was almost unrivalled by his cotemporaries; and even at the present day his sculptures, casts, vases, and medals, are still admired and eagerly sought after. But his violent temper threw him into constant difficulties, and marred the success and good fortune to which his superior genius was entitled. As an author, Cellini holds a distinguished place. His treatise on the arts of jewellery, enamelling, and of making gold and silver vases, and silver statues larger than life, and on the method of casting statues in bronze, on the fabrication of colossal figures, and a discourse on design, is accounted a meritorious production. But the narrative of his own eventful life is one of the most curious and amusing works in any language. The latter was not published till the year 1730, and the English reader has an opportunity of perusing it in the translation of Dr Nugent, which appeared in 1771.

CELLULAR, in its general acceptation, denotes something which is composed of cells, as cellular substance, or membrane, which is employed in anatomical descriptions. See Anatomy.

CELOSIA, Cock's-comb, a genus of plants belonging to the Pentandria class.

CELSUS, a celebrated ancient physician, who flourished in the time of Augustus, and the author of eight books on medicine, which are not only distinguished by the purity and elegance of the Latinity, but are valuable documents relative to the medical practice of the times; and, as Boerhaave has remarked, may be regarded as an illustration of some of the obscure opinions of Hippocrates, the father of medicine. Celsus was also the author of various treatises on other subjects. His work on medicine was translated into English by Dr Grieve in 1756; and numerous editions, with learned commentaries, have appeared at different times.

CELSUS, an Epicurean philosopher, who lived in the second century, is chiefly known as the author of a work entitled the *True Word or Discourse*, which was written against the Christians. To this work an answer was drawn up by Origen, in whose writings, the original being lost, fragments only are preserved; and a summary of the arguments may be seen in the works of Doddridge, Leland, and Sherlock. It appears that Celsus was a man in some estimation among his cotemporaries, for Lucian has dedicated to him one of his works.

CELTS, an ancient people who are supposed to have inhabited the western parts of Europe. According to some authors of great learning, the Celts are to be considered as identically the same with the Scythians or Goths. But later enquirers have taken a different view of the subject, and have attempted to prove that they were quite a distinct people. In the discussion of this question, a good deal of the violence of controversy, and no small degree of irritation, arising perhaps from a kind of national feeling, have been introduced.

Those who maintain the distinction between the Goths and Celts, think, that they have established the following points by their arguments and illustrations. First, That the Syrians, about 1400 years before the Christian era, had proceeded from their original settlements, to the westward and northward, over a large portion of Europe; and that they were afterwards known in history under the name of Getæ, Goths, or Germans, or by the more general appellation of Syrians. Secondly, It appears from the earliest historical records, that the Celts occupied the regions in the vicinity of the Pyrenees about 500 years before the Christian era, and were expelled from their possessions by the Goths, or Germans, and driven into that part of Gaul which they held in the time of Cæsar's invasion. Thirdly, That the Welsh, some of the Irish tribes, and the inhabitants of the Highlands of Scotland, are the descendants of the ancient Celts: And, 4thly, A distinction is obviously made by the Greek and Roman writers between the Belgic and Celtic Gauls.

The distinguishing characteristics between the Celts and Goths, or Germans, are derived from their external appearance, from their religious belief, and sacred institutions,—from their political establishments, and from their language. See Pinkerton's *Enquiry into the History of Scotland*, and *Edinburgh Review*, *Vol. II.*

CEMENT is a substance which is employed for connecting together other bodies; and according to this definition, mortar, which unites the stones of a building, and retains them in their position, is included. The finer kinds of cement, which are employed for uniting broken glasses, earthen or china ware, are usually made of fine quicklime, well mixed with the white of an egg, and immediately applied. The different kinds of lutes for preventing the escape of vapours at the joinings of vessels, and of coatings for iron, earthen ware, and glass vessels, exposed to strong heat, in chemical processes, are sometimes brought under the same denomination. See *Mortar* under ARCHITECTURE, and *Lutes* under CHEMISTRY.

The word cement is also applied to those matters, which, being brought into contact with metallic substances, and subjected to a strong heat, produce very remarkable changes; as when iron, by means of charcoal is converted into steel, and copper by means of zinc becomes brass; and the process itself is called *cementation*.

CEMETERY, from the Greek word which signifies a place of repose, is a piece of ground set apart for the burial of the dead. It is curious to observe the different methods of disposing of the bodies of the dead in different nations, and in different periods of society; and although some nations commit the bodies of the dead to the waters, consign them to sequestered places, or reduce them to ashes by burning, yet it has been by far the most common custom to deposit them in the earth. The burial places of the Jews were caves, or grounds without their cities; and the Greeks and Romans who burnt their dead, deposited the urns in which their ashes were collected in retired places without the walls. The Turks and Chinese, of modern times, select similar places for their burying grounds. The barrows or cairns which are well known in different parts of Britain, are supposed to have been the burial places of persons of distinction who had fallen in battle.

The practice of burying in churches seems to have been first introduced in the fourth century of the Christian era; but it was strongly opposed, and expressly prohibited by various edicts. The porch of the church was at first employed as a cemetery; the bodies of the clergy were next permitted to repose within its walls; and, last of all, the same privilege was extended to persons of distinction among the laity.

CENSUS was a declaration made before the censors, by the subjects of the Roman empire, of the names, places of abode, possessions, families, slaves, and tenants; and the whole being accurately registered, served to shew the strength and resources of the nation. Some suppose that the census was held at Rome every five years, while, according to others, it was only observed at uncertain intervals. The same term is also employed in modern times to the method followed for ascertaining the population of a kingdom.

CENTAUR, in ancient mythology, is a kind of fabulous monster, half man and half horse. According to some, the centaurs were a body of shepherds who inhabited the Arcadian regions. According to others, some young men who had discovered the art of taming horses, undertook to free the mountains of Thessaly from a herd of wild bulls which ravaged the country; and having pursued them on horseback, received the appellation of centaurs. By another interpretation of the fable, the centaurs were a tribe of Lapithæ, who dwelt in a city contiguous to mount Pelion, and who first practiced the art of breaking horses.

CENTAUREA, GREATER CENTAURY, a genus of plants belonging to the Syngenesia class.

CENTER, in the construction of arches, is applied to the framing which supports the stones till the arch is completed. See ARCHITECTURE.

CEPHALANTHUS, BUTTON-WOOD, a genus of plants belonging to the Tetrandria class.

CEPHALIC denotes something belonging to the head, as cephalic medicines, which are remedies for disorders of the head; and cephalic vein, a vein of the arm, from which blood was taken, according to the theory of the ancients, for the purpose of removing complaints of the head.

CEPHALONIA, an island of the Ionian sea, which, with Zante, Corfu, Cerigo, Teaki, Leucadia, and Curzola, forms the republic of the seven islands. See SEVEN ISLANDS.

CEPHEUS, according to ancient mythology, was a king of Arcadia, and was rendered invincible in consequence of Minerva attaching one of the hairs of Medusa to his head.

CEPHEUS, is one of the constellations of the Northern Hemisphere.

CERAM, an island lying between Amboyna and Banda on the south, and the Molucca islands on the north, in the Indian ocean, and about 150 miles in length, and 60 miles in breadth.

CERAMBYX, a genus of insects belonging to the Coleoptera order. See ENTOMOLOGY.

CERASTIUM, MOUSE-EAR, a genus of plants belonging to the Decandria class.

CERATONIA, the CAROB TREE, or ST JOHN'S BREAD, a genus of plants belonging to the Polygamia class. The name, St John's Bread, is applied to the pods of this plant, from an opinion held by some that they were the locusts which St John used with honey in the wilderness, according to Scripture history.

CERAUNIA, a kind of stone frequently alluded to by ancient writers and naturalists, and supposed by some to be the work of art, and employed as a military weapon, or a cutting instrument. The word is derived from the Greek, signifying a thunderbolt; a vague notion seems to have prevailed, that they fell from the clouds during a thunder storm; and hence, modern naturalists have supposed that they are the same with meteoric stones, of whose descent from the clouds the most satisfactory evidence has been adduced.

CERBERUS, according to ancient mythology, was a three-headed dog, born of Typhon and Echidna, and appointed to guard the gates of hell. He is said to have fawned upon those who entered, but devoured all who attempted to return from the infernal abodes; he was conquered by Hercules, who dragged him to the earth, and during the struggle, it is said, the foam which dropped from the mouth of the monster produced the poisonous plant Aconite or Wolfsbane. Some suppose that Cerberus is the symbol of the earth, or of all devouring time, and that the three mouths denote the present, past, and future; but, according to Dr Bryant, Cerberus was the name of a place, and that it signified the temple of the sun. See Bryant's MYTHOLOGY.

CERCIS, JUDAS TREE, a genus of plants belonging to the Decandria class.

CEREALIA were feasts instituted in honour of Ceres, the goddess of corn, and were celebrated with great pomp and ceremony both by the Greeks and Romans. The same term is applied to those gramineous plants, the seeds of which are employed as food.

CERES, the goddess of corn in ancient mythology, was the daughter of Saturn and Ops, and the mother of Proserpine, who being stolen by Pluto, Ceres travelled over the world in search of her daughter, and having come to Celeus king of Eleusis, she undertook the charge of bringing up his infant son Triptolemus. To render him immortal, she fed him in the day time with divine milk, and in the night covered him with fire. Celeus, anxious to discover the manner in which his son was managed, concealed himself in the apartment, and seeing her place the infant under the embers, betrayed himself by a strong expression of his alarmed feelings. The curiosity of the father was punished with death; the son, as he grew up, was instructed in the art of cultivating corn and fruits; and being mounted on a chariot, drawn by winged dragons, he traversed the earth, to teach mankind the use of corn and fruits.

CERIGO, an island of the Mediterranean, celebrated under its ancient name *Cytherea*, as the birth-place of Venus, and is one of the Seven Islands of which the republic of that name is composed. See SEVEN ISLANDS.

CERINTHE, HONEYWORT, a genus of plants belonging to the Pentandria class.

CEROXYLON, WAX-PALM, a genus of plants belonging to the order of palms, and of which the species called *Andicola*, discovered by Humboldt, in the Andes, is the tallest vegetable production yet known. See BOTANY.

CERTIORARI, a term in the law of England, which denotes a writ issued from the court of Chancery or King's Bench, for removing the records of a cause from an inferior to a superior court, for the purpose of considering and determining the validity of appeals or indictments;—of bringing an indictment into the court of King's Bench, when any suspicion exists of partiality in the inferior court;—of pleading the king's pardon;—and of issuing processes of outlawry. Blackstone's *Commentaries*.

CERVANTES, MIGUEL DE SAAVEDRA, the celebrated author of *Don Quixote*, was a native of Spain, and was born at Alcala in New Castile, in the year 1547. He received his education at Madrid, but was more occupied in poetical compositions than in those studies which are requisite for the clerical or medical profession, for one of which he seems to have been destined by the wishes of his friends. Among his earliest productions were an elegy on queen Isabella, another poem, and some sonnets; but the little attention which they excited disgusted the author, and induced him to leave Spain and retire to Rome. The urgency of want compelled him to engage into the service of the cardinal Aquaviva in a menial capacity; but soon wearied of his situation, he entered the army as a common soldier, and served many years in this humble rank. In the battle of Lepanto, which was fought in 1571, he lost his left hand; and in 1574 he was doomed to slavery at Algiers, and experienced the most rigorous bondage from a barbarous master. He and his countrymen having made several attempts to escape from the harshness and cruelty of their condition, were at last betrayed, and called before the Dey, to receive, as they dreaded, the unmitigated sentence which might doom them to torture and death. To their surprise and astonishment a pardon was offered, on condition of discovering the author of the plan of escape. They all hesitated, when Cervantes came boldly forward, and declared himself to be the man. His daring intrepidity struck his savage masters, and rescued him from punishment; in succeeding attempts, in which he failed to regain his liberty, he was also pardoned; and even when he was detected in plots of a deeper nature, in stirring up insurrection and open rebellion, he was still fortunate in escaping the punishment which usually follows such violent schemes. He became, at last, the property of the Dey himself, and was shut up in close confinement.

The demand of 500 crowns of gold for his ransom, seems to indicate that he was regarded as a person of some rank. The sum was at last made up by the exertions of his parents and the benevolent contributions of others, and being transmitted to Algiers, Cervantes was restored, in 1580, to his native country. The commencement of his literary career is dated from this period, and his first work, after his return to Spain, was a pastoral entitled Galatea, which was well received by the public, and contributed to raise the reputation of the author. The famous *history of Don Quixote* was his next production, and is said to have had its origin in an incident which befel Cervantes himself while he was travelling in la Mancha. In a village of that province he was thrown into prison, either in consequence of having contracted debts or of a quarrel with the inhabitants, and while he remained in durance he composed the first part of the adventures of his renowned hero.

Cervantes was also the author of some comedies and novels; but they are comparatively little known, and quite thrown into the shade by the brilliancy of genius which adorns his Don Quixote. This work is intended as a satire on books of knight-errantry, which had so infatuated the greater part of mankind, and especially the Spanish nation. It was universally read, and painters, workers in tapestry, engravers, and sculptors, have exercised their ingenuity and talents in representing the history of Don Quixote. While Philip III. stood on a balcony of his palace at Madrid, he observed a student on the banks of the river Manzanares reading a book, and from time to time breaking off and striking his forehead with great enthusiasm. The king remarked to those near him, that the scholar was either mad or reading Don Quixote.

Few English readers are unacquainted with this work in their own language, and it has been translated into all the languages of Europe. Cervantes died in the year 1616; and with all the reputation which he acquired, it is melancholy to record, that he experienced, through the greater part of his life, all the hardships and miseries which accompany poverty.

CERUSS, or WHITE-LEAD, is a compound of oxid and carbonate of lead, which is usually prepared by exposing plates of the metal to the vapour of vinegar. It is used as an external application in medicine, and extensively employed in painting.

CERVUS, a genus of quadrupeds belonging to the order of Pecora, and including the deer, the antelope, and the goat. See MAMMALIA.

CERYX, a public crier or herald among the Greeks, corresponding to the *præco* of the Romans. Of these heralds two classes were established, the one of a civil nature, whose duty it was to call assemblies of the people, and to preserve the necessary silence and decorum in their public meetings. The other class was of a sacred character, and was regarded as a kind of priests, who proclaimed festivals, led the victims to the altar, and ordered all matters connected with public sacrifices and public games. This order of priesthood, called *ceryces*, was confined to a particular family, the descendants of Ceryx, the son of Eumolpus.

CESSIO BONORUM, a process in the law of Scotland, by which an insolvent person, who has been committed to prison by his creditors, may obtain his liberation by surrendering his whole real and personal estate. In most nations, in the early periods of society, bankrupts, or persons who were unable to discharge their debts, were treated with great harshness and severity, were regarded as degraded characters, and compelled to submit to the most humiliating ceremonies. In such cases the failure seems to have been ascribed to misconduct, and no discrimination was made between imprudence and misfortune. Among the Romans, by a law of the twelve tables, debtors were delivered over to their creditors, and might be kept in chains. By a subsequent enactment, their effects only were required to be given up; and, finally, the *cessio bonorum* introduced by Julius Cæsar, the operation of which was at first limited to Italy, was extended to all the Roman provinces before the time of the emperor Dioclesian. This law, which protected the person of the debtor from imprisonment, was adopted by those European nations who formed their systems of jurisprudence according to the Roman code.

By the law of Scotland, the debtor who claims the privilege of *cessio bonorum*, must have been at least one month in prison; and he is only entitled to it where no fraud exists. This process is always conducted before the court of Session, and the effect of it is to provide security against imprisonment; for the debt is not discharged, since any property acquired afterwards by the debtor, is liable to be attached by the creditor. This law requires also that persons liberated on a *cessio bonorum* shall submit to certain ignominious acts, as the wearing of a particular dress called the *dyvour's habit*. But the observance of this degrading distinction, if not formally abolished, has gone into desuetude. It is now always dispensed with. *Bell's Commentary on the Bankrupt Law.*

CESTRUM, BASTARD JESSAMINE, a genus of plants belonging to the Pentandria class.

CETE, in the Linnæan arrangement of animals, is the seventh order of the class Mammalia, and includes the whale tribe, which, in their mode of respiration and other functions, are connected with that class of animals under which they are described by Linnæus; but in their external form, locomotive powers, in their mode of life, and the element in which they reside, are allied to fishes. It will therefore be no great violation of arrangement, to detail the natural history of this tribe of animals in a separate division, under the tribe of fishes. See ICHTHYOLOGY.

CETOLOGY, denotes a treatise on the Cete or whales, which is the seventh order of the class Mammalia in the Linnæan arrangement. See ICHTHYOLOGY.

CEUTA, a sea-port town in the kingdom of Fez in Africa, which is situated on the southern coast of the Mediterranean, and nearly opposite to Gibraltar, from which it is not more than 15 miles distant. It has a commodious harbour for small vessels, is the see of a bishop who is suffragan of Lisbon, was taken from the Moors in the year 1409 by the Portuguese, continued annexed to Portugal till the revolution in 1640, when it fell under the dominion of Spain, and was finally ceded in 1688 to that country by the treaty of Lisbon. Succeeding attempts of the Moors to recover it failed, and finally left it in the hands of the Spaniards.

CEYLON, an island in the Indian ocean, at the southern extremity of Hindostan, from which it is separated by the gulf of Manaar, a narrow strait anciently called *Sinus Colchicus*, full of shoals and small islands, to which the natives have given the whimsical name of Adam's bridge, from the popular belief that our first parent, after his transgression and consequent loss of paradise in this island, passed over by it to the adjoining coast. Ceylon lies between 5° 40′, and 10° 30′ North Lat. and between 79° and 82° East Long. about 150 miles distant from Cape Comorin. It is reckoned 900 miles in circumference; its greatest length being nearly 300 miles, and its breadth varying from 40 to 150 miles. In shape it somewhat resembles a pear, the smaller or narrower extremity of which is towards the north, at the peninsula of Jafnapatam, hence vulgarly denominated by the Dutch *Hams-heel*, as Point Pedro, in its vicinity, is, with no less suitableness, styled *Hams-heel point*. In approaching from the sea, this island presents a green and fertile appearance, considerably more pleasing than most parts of the Malabar and Coromandel coasts; the one lying on the west, and the other on the east side of the vast peninsular continent, to which Ceylon seems to form an appendage. Its shores are flat and covered with verdant foliage, or display groves of cocoa-nut trees, alternating with rice fields, except on some parts of the eastern coast, which are bald and rocky. Steep and elevated mountains, clothed with thick forests, and full of almost impassable jungles, occupy the interior, and nearly divide the island into two parts, which differ materially from each other in climate and seasons. The general direction of these mountains is from north to south; some of them are of great height, and are the topic of several superstitious opinions in the mythology of the people. From the precipitous nature of the mountains, most of the rivers, with which Ceylon is so plentifully watered, are rapid and broken in the early part of their course. But they become uniform and tranquil towards the flat lands which skirt the central regions, and are unusually smooth, though rarely navigable at their outlet. Those of chief note are the Malivagonga and the Mulivaddy. Besides its rivers, Ceylon possesses a great number of lakes and canals communicating with them, some of which are of considerable extent, and render important benefits to the natives, as a ready mode of transporting goods, and a plentiful source of fresh water fish. The principal harbours are Trincomalee, and Point de Galle; but at certain seasons ships may moor safely in the roads of Columbo, and several smaller ports afford occasional shelter to coasting vessels.

The climate of this island, in general, is more temperate than that of India. The sea coast is more particularly well favoured in this respect, in consequence of the almost constant sea breezes, which moderate the heat, but which are scarcely known in the interior, from the impervious nature of the surrounding hills and forests. To the same obstructing cause is to be ascribed the little effect of the monsoons on the central regions, which consequently preserve an almost invariable state of temperature throughout the year. This is necessarily high and sultry in those parts. The monsoons nearly correspond with those of the adjoining continent, but are somewhat earlier on the western than on the eastern side. The seasons are more influenced by these monsoons than by the course of the sun; and hence, though it is situated to the north of the line, this island has its coolest season during the summer solstice, when the western monsoon prevails. Spring begins in October, and the hottest weather is experienced in the period from January to the beginning of April. In the wet season, which happens in March and April, the rain pours in torrents, and thunder and lightning are displayed in a manner quite unknown in European countries. From its situation with respect to the equator, the days and nights are nearly of the same length throughout the year, the greatest variation in their proportions not exceeding 15 minutes.

The soil of this island is sandy, with a small addition of clay. Marshy grounds are met with on the south-west parts, which are peculiarly fertile. Properly speaking, the sowing season is in July and August, and the harvest about February. But the inhabitants are little attentive to natural indications, and seem to expect equal success at all times. Rice is among the chief products cultivated, but, according to Mr Percival, is not raised in sufficient quantity for the demands of the people, who annually obtain large supplies from Bengal and other places on the continent. The defect, in that author's opinion, is entirely owing to mismanagement; and he is convinced, that, with proper attention, the necessity of importation might be readily obviated. Fruits of various kinds, peculiar to tropical countries, are abundant in Ceylon. Besides pine apples, pomegranates, citrons, oranges, &c. it boasts of the *mango*, one of the most delicious productions of India, two species of the bread-fruit tree, the tamarind, the sugar-pea a species of palm, the tea-plant, variety of spiceries, and the cinnamon tree in great quantities. Its flowers are not so numerous, nor so much attended to, according to the author named, but have an exceedingly rich odour, and sometimes are highly beautiful.

The mineralogy of Ceylon is varied, interesting, Ceylon. and valuable. Its sapphire, amethyst, and tourmaline are in great esteem, but its ruby, topaz, and diamond are inferior to those of Golconda and the Brasils. Carnelians and rock-crystal are in great plenty. The cat's-eye, a species of opal, is rarer, and bears a high price. Ores of lead, tin, and iron are met with in the interior, but are seldom wrought. Some mines of quicksilver have been found. The precious metals appear to be extremely scarce. The pearls, which form so great an article of commerce in this island are whiter than those of the gulf of Ormuz and the Arabian coasts.

In the zoology of Ceylon, the elephant holds the first rank, being produced in great numbers, and excelling in shape and appearance that of any other part of the world. The domestic animals are not numerous. The oxen are small, and not well-shaped. Horses and sheep do not thrive in the island. Buffaloes are found in great numbers, and are often employed to draw burthens. Hares, like those of Europe, are very plentiful. The wild hog frequents the forests. A small species of tyger, the tyger-cat, the leopard, hyena, and bear, are natives. Monkeys swarm, so do squirrels; and there is great variety of porcupines, racoons, and armadilloes. The birds are numerous. All our domestic poultry are found native. Snipes, parrots, pigeons, crows, wood-peckers, and a species of crane, are abundant. Kites and vultures are not frequent. Two species of peacock are indigenous. Among the reptile insect tribes may be enumerated the cobra de capello or hooded snake, whose bite is generally mortal, the cobra mamilla, a still more terrible creature, the rock snake, an immense species, sometimes extending to 30 feet in length, but free from poison, alligators of vast size, lizards, and chamæleons. A particular kind of leech is mentioned by Mr Percival as a formidable assailant on the traveller. It is quick in its motion, and readily contrives to fasten on a person's clothes, through which it is sure to find access to the skin. "On our way to Candy," says he, "in marching through the narrow paths among the woods, we were horribly annoyed by these vermin; for whenever any of us sat down, or even halted for a moment, we were sure to be immediately attacked by multitudes of them; and before we could get rid of them, our gloves and boots were filled with blood. This was attended with no small danger; for if a soldier were, from drunkenness or fatigue, to fall asleep on the ground, he must have perished by bleeding to death." Spiders, beetles, butterflies, and almost all the insects found in Europe, are met with in great numbers, besides other species peculiar to tropical countries. The white ant is a most destructive creature, and commits ravages both in the fields and dwelling-houses surpassing any idea of their operations that could be formed from our own species.

The population of Ceylon, which, according to Mr Cordiner, amounts to 1,500,000, consists of different races of mankind. The original inhabitants, or Ceylonese, till lately, were divided into two classes; those under the British government denominated Cingalese, and those of the interior, under their native princes, known by the name of Candians. These, though on the whole one stock, exhibited peculiarities to be attributed to the different circumstances in which they were placed. The recent acquisition of those parts of the island, which so long resisted the ambition and power of our countrymen, will probably soon obliterate their distinctions. Besides these people, and the Europeans settled in the country, are the Malays, and a numerous race known under the name of Portuguese, being the mixed progeny of those foreigners and the native females. Mr Percival has specified the distinguishing characteristics of all those inhabitants in a manner sufficiently interesting to warrant commendatory reference to his work.

This island, till lately, was considered as divided into two parts; the central regions, constituting the dominions of the king of Candy, and the maritime district surrounding that kingdom subject to Great Britain. The chief places worthy of notice in the former were, Candy, the capital, an ancient, but meanly-built town, near the centre of the island, almost entirely destitute of artificial defence, and containing no edifices deserving description; Badoula, a large town, with a decayed palace, to the south-east of Candy; Allout-neur, where the royal magazines of corn, &c. were preserved, 10 or 12 leagues north-east of the capital; and Digligy-neur, formerly a royal residence, a few leagues to the east of Candy. The principal places on the coast are, Columbo, the capital of the European settlements, a large, well-built, and populous town, situate in a fertile district, defended by a fort, and possessing a harbour, or rather road, in which vessels may safely anchor from December to April; Point de Galle, a populous trading town, 70 miles south of Columbo; Jafnapatam, a considerable town, chiefly inhabited by manufacturers, near the northern extremity of the island; and Trincomalee, a walled town of large extent, but thinly inhabited, lying on the east of the island, at the entrance of an excellent bay.

The principal commodities exported from Ceylon are, pepper, cinnamon, betel-leaf, cocoa-nuts, and oil; honey, and wax; cardamoms, and other aromatic spiceries; coral, ivory, and fruit. Coya-rope, or cordage, is manufactured in large quantities near Columbo, and sent to the British vessels frequenting the Indian sea.

The revenues are supposed to be much improved since the island came into the hands of the English, but are perhaps scarcely as yet commensurate to the expence of government and protection. No long time, surely, can elapse before the benefits of its entire subjection can be realized.

Little is known of the history of this singular island before the arrival of the Portuguese under Almeyda in 1505. The natives, long harassed by the attacks of the Arabs, readily consented to pay tribute to these Europeans, in consideration of being assisted against their invaders. At this period, some savages, called Bedas, occupied the woody regions; the rest of the island was possessed by the Cingalese, who do not seem to have differed much from their descendants. Not content with a friendly alliance, the Portuguese endeavoured to form a settlement in the island, in which they succeeded, after a long and severe struggle, under Albuquerque, the successor of Almeyda. The sea-coast fell into their hands, and the interior alone remained to the original possessors. Avarice was the ruling principle with these new masters; and hence the rights and interests of the natives were entirely overlooked, or unjustly violated. Bigotry was the next agent in the policy of the Portuguese, and gave, if possible, greater offence. Thus, dissatisfaction and war continued between the two people for nearly a century, when the Dutch, having thrown off the yoke of Spain, urged their way to the east, and reached this island. They were favourably received by the oppressed natives, and being assisted by them, at last overpowered the Portuguese, who yielded the dominion in 1656. But the conduct of these successful allies soon offended the natives almost as much as that of their predecessors; and hostilities of a long duration took place between them, in which, on the whole, the Dutch were the greatest sufferers, though the Ceylonese were eventually driven to the fastnesses of the interior, where alone they could preserve their independence. A treaty was at last concluded between the two parties in 1766, which inflicted several hardships on the king of Candy, but left him at least the name and somewhat of the appearance of royalty.

The American war brought the English to this island. But their arms, though victorious, were not rewarded with permanent success, till the contest with revolutionary France and her allies induced a new and powerful expedition against it, under general Stewart, in 1796. Since that period various transactions have occurred between our countrymen and the Candians. A treaty of alliance and commerce was projected in 1800, but failed. Our troops took possession of their country and capital in 1803; but being unable to maintain their conquests were forced to capitulate, on condition of liberty to return to Columbo. In place of this being fulfilled, however, they were treacherously put to death with circumstances of the most savage cruelty. An expedition of 3000 men, fitted out in 1815, under the command of General Brownrigg, in concert with the inhabitants, who had become weary of their tyrannical and blood-thirsty monarch, entered his capital in triumph, and in a few days afterwards captured the monster himself, and deprived him of all power. The people delighted at their deliverance, readily transferred their allegiance to their rescuers, and appear already to experience the blessings of a British government.

CHÆRONEA, a village of Bœotia in Greece, which is celebrated as the birth place of Plutarch, and is still more famous on account of the signal disaster which the confederated Greeks experienced when they were defeated by Philip king of Macedon.

CHÆROPHYLLUM, CHERVIL, a genus of plants belonging to the Pentandria class, and the natural order of umbellated plants.

CHÆTODON, a genus of fishes. See ICHTHYOLOGY.

CHAINWORK, a species of cloth manufacture, in which the threads are linked or united together somewhat in the manner of a chain, as in the case of hosiery and various kinds of fancy weaving, both of silk and cotton fabrics. See CLOTH MANUFACTURE and HOSIERY.

CHALCEDONY, or CALCEDONY, a mineral substance, which, on account of the fine polish of which it is susceptible, is employed in jewellery. See *Chalcedony* under GEOLOGY.

CHALK, a well known mineral substance, which abounds in England and some other countries, but is never met with as a natural production in Scotland. See GEOLOGY.

CHALLENGE, an invitation or summons sent by one person to provoke another to fight a duel. A challenge of this description either verbal or written, or even the bearer of such a challenge, is punishable by fine and imprisonment, on indictment, or information.

CHALLENGE, according to the law of England, is an exception made to jurors either in civil or criminal cases.

In civil cases, challenges are of two kinds, either to the array or to the poll. In the first case, the challenge extends to the whole jury on account of partiality, as in the case of nominating the jury under the direction or influence of either party. Challenges to the poll, are exceptions to particular individuals who are nominated to sit on the jury. Similar exceptions, and on similar grounds, are permitted in criminal cases. Blackstone's *Commentaries*.

CHALONS SUR MARNE, the capital of the department of Marne in France, includes a population of more than 11,000, and has considerable manufactories of woollen stuffs.

CHALONS SUR SAONE, a town of the department of Saone and Loire, contains 12,000 inhabitants, has a considerable trade in grain, wines, and iron, and retains some celebrity on account of the ruins of Roman edifices which are yet visible.

CHAMÆLEON, a species of Lacerta, which is remarkable for its powers of changing colours. See *Lacerta* under ERPETOLOGY.

CHAMÆROPS, the FAN PALM, a genus of plants which belongs to the order of palms. See BOTANY.

CHAMBERLAIN, one of the great officers of state in Britain, who is reckoned the sixth in rank, holds his office by hereditary right, and is charged with the direction of the ceremonies observed at coronations and other solemn occasions. The lord-chamberlain of the royal household has the superintendence of all officers belonging to the king's chamber, as artificers, serjeants at arms, chaplains, and physicians, as well as of the wardrobe, and of all matters connected with theatrical exhibitions, and particularly the licensing of plays for representation.

CHAMBERS, EPHRAIM, the author of the Cyclopædia, or Dictionary of Arts and Sciences, which is distinguished by his name, was a native of Westmoreland in England, and was apprentice to Mr Senex, the globe-maker, in London, a business which requires or leads to some practical knowledge of geography and astronomy. During this time, it is said, he formed the design of the Cyclopædia, and for the purpose of executing that laborious undertaking, he resigned his mechanical employments, and retired to apartments in Gray's inn, which was chiefly his place of residence during the rest of his life. The first edition of the Cyclopædia, which was published by subscription, appeared in 1728 in two vols. *folio.* A second edition was called for in 1738, and a third followed in the succeeding year.

The literary labours of Mr Chambers were not solely confined to the Dictionary. He was a contributor to the *Literary Magazine*, which commenced in 1735; and in conjunction with Dr Martyn, professor of botany at Cambridge, he presented to the world an abridged translation of the Memoirs of the Academy of Sciences at Paris, on the subject of natural philosophy. This work, amounting to 5 vols. *octavo*, appeared in 1742.

The severe studies in which Mr Chambers had been engaged affected his health, and obliged him to retire occasionally to the vicinity of the metropolis, to enjoy the benefit of a purer air. A visit to the milder climate of the south of France did not contribute to his recovery; and soon after his return to England he died, and was buried at Westminster abbey, where an inscription in elegant Latin, said to have been written by himself, alludes to the business of his life, and marks the period of his death in 1740.

Two other editions of the Cyclopædia were published after the author's death; a supplement consisting of two volumes was afterwards compiled; in the year 1778 a new edition, in which the whole was incorporated into one alphabet, was completed in four vols. *folio*, under the superintendence of Dr Rees; and the same learned author has now (1818) nearly finished the most extensive edition of that work, probably not less than 40 vols. 4to, which has yet appeared.

CHAMBERY, a town of Savoy in Italy, is finely situated in a valley encompassed with mountains, includes some elegant houses and magnificent public buildings, and reckons about 12,000 inhabitants, who are engaged in the manufactures of stockings, silk thread, and leather, in the working of marble, and in the distillation of liqueurs, which are greatly esteemed.

CHAMOIS, or CHAMOIS GOAT. See *Cervus* under MAMMALIA.

CHAMOUNI, an elevated valley of the Alps, which lies north from mount Blanc, and south-east from the lake of Geneva, is about 18 miles in length from north-east to south-west, and is not more than a mile and a half at its greatest breadth. The vale of Chamouni is more than 3,000 feet above the level of the sea. For six months of the year, from November to May, it is covered with snow, and in some places of great thickness; but the short summer is warm and agreeable. The river Arve flows through its centre, and in its course is joined by some mountainous torrents.

The population exceeds 3000. The cultivated crops are oats, barley, beans, and flax; but the dairy husbandry is an object of greater attention, and a good deal of butter and cheese is produced. The rearing of bees is also much attended to, and the honey thus obtained, which is in high estimation for its delicious taste and rich flavour, is a source of considerable profit.

Many of the inhabitants of Chamouni are engaged in the hazardous occupation of hunting the Chamois goat, an animal which frequents the steepest and most inaccessible rocks, and in the search for rock-crystal, which is found in the cavities of the precipitate cliffs of the Alpine region. The numerous travellers who frequent this valley for the purpose of visiting mount Blanc, avail themselves of the proffered services of the inhabitants, who are found to be expert and faithful guides in that arduous undertaking. The celebrated naturalist Sanssure has drawn an animated picture of the inhabitants of this valley, and of their occupations, manners, and mode of life.

CHAMPAGNE, a province of France; according to its former topographical divisions, is about 160 miles long and 112 miles broad; has for its boundaries on the north and west, Hainault, Luxembourg, and the isle of France; and on the east and south, Lorraine, Franche Compte, and Burgundy, and is watered by the Meuse, the Seine, the Marne, the Aube, and the Aine. It is now divided into several departments.

CHAMPION, a person who engages to fight in single combat in the cause of another, and sometimes in his own cause. According to the barbarous practice of rude nations, the method of settling disputes by single combat between the parties concerned was common; and the form of judicial combat was arranged and established by legislative enactments, in times in which it might have been expected that such absurd and unjust proceedings would not have appeared. It is not a little singular, that the laws of England with regard to this kind of trial, or *wager of battel*, stands at this day unrepealed.

The female sex, infirm persons, and those who were advanced in life, or were of the clerical profession, were permitted to employ a substitute, or a champion, to fight in their cause; but afterwards the champion appeared in all cases, and at last became a necessary part of a great man's establishment.

In this capacity the champion of the king appears at the coronation, and when the king is at dinner, he rides into Westminster hall, fully armed, and by the proclamation of a herald, declares, that if any man shall deny the king's title to the crown, he is there ready to defend it in single combat. This office is hereditary; and in a competition in the time of Richard II. it was adjudged to Sir John Dymocke, in whose family, holding a manor in Lincolnshire, it has ever since remained. Sir Edward Dymocke discharged this duty at the coronation of Charles II. and the same ceremony was performed by a person of that name at the coronation of George III.

CHANCE, a term which is applied to those events of which the immediate cause is not known. Those things are ascribed to chance which are not necessarily produced as the natural effects of any proper cause; but it must be observed, that effects are attributed to chance which really have a necessary and determinate cause. In strict language, therefore, when a thing is said to happen by chance, nothing more is meant than that the cause is unknown.

The doctrine of chances constitutes a curious subject of mathematical investigation, which is directed to ascertain the probability of the occurrence of such events as cannot be predicted with certainty from want of knowledge of their true causes. The chances of play, or the probable result of those circumstances which are not subject to the skill or management of the players, belong to this investigation. Such, for example, are all games which depend on the shuffling of cards or the throwing of dice, and such too is the nature of lotteries. But the most important application of the results of this investigation is in the determination of questions relative to the probable duration of human life. Annuities depending on lives, and life-insurances are regulated by the doctrines established by such enquiries. See De Moivre's *Doctrine of Chances*, and Simpson *on the Nature and Laws of Chance*.

CHANCE-MEDLEY, is a term in the English criminal law, which denotes the lowest kind of homicide to which any punishment is adjudged; and consists in causing the death of a man, upon occasion of a sudden quarrel, and in self-defence. But the self-defence must have been had recourse to after other means of self-preservation have failed, otherwise the offence will be considered man-slaughter. In the case of homicide by misadventure, the act of killing is intentionally necessary for self-preservation; but in chance-medley no intention of committing injury exists,—as when the head of a hatchet, with which a man is employed at work, flies off and kills a spectator. In both cases the law presumes that the occasion of killing might have been avoided, in the one by a greater care, and in the other by abstaining from the quarrel which terminated so fatally.

CHANCELLOR is said to have been at first the chief notary, or scribe, under the emperors. According to some, the name is derived from the Latin word signifying a *lattice*, behind which he sat, to avoid being crowded by the people; and, according to others, from *cancellare*, to cancel. This officer was afterwards invested with judicial powers; and when the modern kingdoms of Europe were established upon the ruins of the empire, almost every state preserved its chancellor, with different jurisdictions and dignities, according to the nature of their civil constitutions. When the use of seals was adopted in solemn deeds, the custody of the king's great seal was intrusted to the chancellor.

The Lord Chancellor of Great Britain possesses the highest judicial authority in the kingdom; he is created by the mere delivery of the king's great seal; is a privy-counsellor by his office, and, by prescription, the prolocutor or speaker of the house of Lords. All the justices of the peace in the kingdom are appointed by him. In right of the king he is the visitor of all hospitals and colleges on the royal foundation; he is the patron of all the king's livings under the value of L.20 *per annum*; is the general guardian of all infants, idiots, and lunatics, and has the superintendence of all charitable uses. In his judicial capacity in the court of Chancery, he exercises a very extensive jurisdiction. He takes precedence of all temporal lords, except those of the royal family, and of all the spiritual lords except the archbishop of Canterbury.

CHANCERY, the highest court of justice in the kingdom next to Parliament, and deriving its name from the Lord Chancellor, who presides in it. The jurisdiction of the court of Chancery is either ordinary, or a court of common law, or extraordinary, or a court of equity. The *ordinary* legal court holds pleas of recognisances acknowledged in the chancery, writs of *scire facias*, for repeal of letters patent, writs of partition, as well as of all personal actions, by or against any officer of the court. Sometimes a *supersedeas* or writ of privilege, is granted to discharge a person out of prison; one from hence may have *habeas corpus* prohibition, &c. in the vacation: and here a *subpœna* may be had to force witnesses to appear in other courts, when they have no power to call them. But if the prosecution of causes of trial by jury be required, the Lord Chancellor delivers the record into the King's Bench; and after trial it is remanded into the Chancery, where judgement is pronounced. In this court also is kept the *officina justitiæ*, out of which all original writs that pass under the great seal, all commissions of charitable uses, bankruptcy, lunacy, and the like, are issued. The writs relating to the business of the subject were originally kept in a hamper, and those connected with the crown were preserved in a small bag, and hence the distinction of the *Hanaper Office*, and the *Petty-Bag Office*.

The *extraordinary* court proceeds according to the rules of equity, and considering the intention rather than the words, moderates the rigour of the common law. It gives relief for and against infants during their minority; for or against married women; takes cognizance of frauds and deceits for which there is no redress at common law; of all breaches of trust and confidence; of the confirmation of titles to land where any defect exists; of money or lands given to charitable uses; and, in general, of all matters which cannot be settled by the rules of common law. Blackstone's *Commentaries*.

CHAPEL, derived from the Latin, *Capella*, is a place of divine worship. In the early periods of the French history it was usual for the kings of France, when they were engaged in war, to carry into the field the hat of St Martin, which was esteemed a precious relic; the tent in which it was kept was called *capella*, and the priests who had the charge of it were called *capellani*; and the same word *capella* was afterwards applied to private oratories or chapels.

Several kinds of chapels are known in Britain as *parochial* chapels, which differ little from parish churches; they are generally small, and the inhabitants within the district few; chapels which form part of churches, and were erected by persons of distinction as burying places for their families; chapels-of-ease, erected in large parishes where the people cannot be conveniently accommodated in the parish church; free chapels, which were founded by kings of England, and are free from episcopal jurisdiction; they are only to be visited by the founder and his successors, which is done by the Lord Chancellor; chapels in the universities, which belong to particular colleges; and domestic chapels, erected by private individuals for the performance of religious duties in their own families.

CHAPLAIN, denotes a person who discharges the duty of a chaplain, or is applied to a clergyman who attends in the house of a prince or a person of rank for the purpose of performing divine service in the private chapel of the family. In England the king has 48 chaplains, four of which attend monthly, preach in the chapel, read the service to the royal family, and to the king in his private oratory. The king has six chaplains in Scotland, with a salary of L.50 each; and three of them having, in addition, the deanry of the chapel-royal divided among them, increases their appointment to L.100 each. The only duty required of them is to say prayers at the election of the representatives of the peers in parliament.

According to a statute of Henry VIII. the persons who have the power of retaining chaplains, and the number which they are allowed to qualify, are specified. An archbishop may retain eight; a duke or bishop six; a marquis or earl five; a viscount four; a duchess, marchioness, countess, baroness, the treasurer and comptroller of the king's house, clerk of the closet, the king's secretary, dean of the chapel, almoner, and master of the rolls, each of them two; chief-justice of the king's Bench and warden of the cinque-ports, each one. All these chaplains may purchase a licence or dispensation, and take two benefices with cure of souls.

CHAPTER, a society or community of clergymen, belonging to cathedrals or collegiate churches, first assumed this appellation in the eighth century, and in a cathedral formed the council of the bishop, and during the vacancy of the see held the jurisdiction of the diocese. In the earlier ages the bishop was the head of the chapter, but abbots, deans, provosts, and treasurers were afterwards preferred to this distinction. The power of electing bishops was taken from the dean and chapters by Henry VIII. and vested in the crown. The same monarch expelled the monks from the cathedrals, and placed secular canons in their stead. Those who were subjected to these regulations were called deans and chapters of the new foundation; among which are Canterbury, Winchester, Ely, and Carlisle.

CHARACTER, from the Greek word, which signifies to cut or engrave, is, in its general meaning, a mark or figure denoting something which is not directly represented. Characters are of different descriptions, as literal, or those which represent the letters of the alphabet, numeral, which are used to express numbers, and are either letters or figures, and abbreviations, which are employed in various arts. See LANGUAGE.

CHARADE, a kind of literary composition, which, it is said, bears the name of the inventor. The subject is a word of two syllables, and each of these constitutes a distinct word. In the construction of the charade these two syllables are concealed in a kind of enigmatical description, first separately, and then together. This amusement, if not useful, is innocent, and affords exercise to ingenuity. The following examples will be a sufficient illustration of the nature and construction of the charade.

My *first* is ploughed for various reasons, and grain is frequently buried in it to little purpose. My *second* is neither riches nor honours; yet the former would generally be given for it, and the latter is often tasteless without it. My *whole* applies equally to spring, summer, autumn, and winter; and both fish and flesh, praise and censure, mirth and melancholy, are the better for being in it.—*Sea-son.*

My *first* is equally friendly to the thief and the lover, the toper and the student. My *second* is light's opposite; yet they are frequently seen hand in hand; and their union, if judicious, gives much pleasure. My *whole* is tempting to the touch, grateful to the sight, fatal to the taste. *Night-shade.*

My *first* is called bad or good,
May pleasure or offend ye;
My *second*, in a thirsty mood,
May very much befriend ye.
My *whole*, though styled a cruel word,
May yet appear a kind one;
It often may with joy be heard,
With tears may often blind one.—*Fare-well.*

CHARADRIUS, a genus of birds, which includes the plover and dotterel. See ORNITHOLOGY.

CHARCOAL, a kind of artificial fuel, which is prepared by a smothered combustion, from wood or mineral coal, although the latter is often distinguished by the name of coak. Charcoal, which possesses many remarkable chemical properties, is generally prepared from small pieces of wood, and white resinous wood is unsuitable for this purpose. Different woods, too, it may be observed, afford very different proportions of charcoal. The great consumpt is in the iron-works, or in other cases where a strong heat without smoke is required.

Wood is charred, or converted into charcoal, in the following manner. It is first cut into proper lengths, and piled up in heaps, the stacks are constructed in three different ways; according to the first method a convenient spot of ground about 12 or 15 feet in diameter is levelled, and in the centre of this area a large billet of wood split across at one end and pointed at the other, is fixed by its pointed extremity in the earth, and two pieces of wood are inserted through the clefts of the other end, forming four right angles; against these cross pieces four other billets of wood are placed, one end on the ground and the other leaning against the angles. Straight billets are then laid on the ground to form a floor, each of these billets being the radius of the circular area. A quantity of brushwood is then strewed on the floor to fill up the interstices. And to keep the billets in the same position in which they are first arranged, pegs are driven into the ground in the circumference of the circle, about a foot distant from each other; on this a floor or stage is built with billets set upon one end and slightly inclining towards the centre. On the top of these billets another floor is laid in a horizontal direction, but of shorter billets; so that the whole when finished may be of a conical form.

A second method of building stacks for charring wood, is to erect a long pole in the centre of the area, and several small billets are ranged around the pole on their ends, while the interstices between the billets and pole are filled with dry brush wood; a floor is then laid, and on that a stage in a reclining position, and on the stage a second floor in the same way as in the first method of forming the stack. But

Charente.

in the lower floor, a billet larger and longer than the rest extends from the central pole to some distance beyond the circumference of the circle.

By a third method of constructing the stack, a chimney or opening, of a square form, is made with billets in the centre from the bottom to the top, and round them floors, on inclined stages, are raised in the same way as in the former stacks, excepting that the base of the stack in this mode of construction is square instead of being circular, and when it is completed the whole stack is of a pyramidal form.

In whatever way the stack is constructed, it is covered over with a coating of turf, and the surface is plastered with a compound of earth and charcoal dust well mixed together.

If the stack be constructed according to the first method, the central billet in the upper stage is drawn out, and some pieces of dry wood are placed in the chimney or vacant space, and set fire to. In the second method of construction, both the central pole and the large horizontal billet are drawn out, and the vacant space which was occupied by the latter, is filled with pieces of dry wood, to which the fire is applied at the base of the stack. In the third method of construction, the chimney or square opening is filled with dry pieces of wood, and the fire is applied at the top of the pyramid.

Great care is requisite in the management of the fire. When the flame begins to rise to some height above the chimney, the opening should be covered with turf, but not so close as to prevent the smoke from passing out; and in the course of the operation, if a thick mass of smoke appear to issue from any part of the pile, the opening must be covered up with a mixture of earth and charcoal dust. To ensure the equal combustion of the whole stack, it is necessary that the workman make openings in one part, and close them in another. In this way the fire is kept up till the charring process be completed, which for dry wood requires about two days and a half, and for green wood not less than three days.

When the charcoal is sufficiently burnt, which is indicated by the cessation of the flame, and the appearance of the smoke, the whole is covered up to exclude the air and prevent the further progress of the combustion; the fire then goes out, and in the course of a few days the stack may be taken down. Some precautions are necessary to avoid the danger which may arise from the sudden explosion of the carburetted hydrogen gas, which is copiously evolved during the process. Part of the covering of the stack is usually thrown off during these explosions.

Charcoal is chiefly employed as fuel; it forms one of the constituent parts of gun powder; is used as a tooth powder, and to polish brass and copper; is the bases of black paints and varnishes, and is applied for clarifying liquors. For its peculiar properties, see CHEMISTRY.

CHARENTE, a department in France, comprehending the ancient province of Angoumois, with part of Saintonge and Limosin. It lies to the south of Vendee, is about 30 French leagues in length, and 25 in breadth, contains 300 square leagues, is divided into five circles, viz. Ruffec, Confolens, Angoulesme, Barbezieux, and Cognac, and has a population of more than 300,000 souls. The name is derived from the river Charente, which has its origin in Limosin, and runs by Angoulesme and Saintes into the bay of Biscay, opposite to the island of Oleron. Much of this department is either barren or covered with woods, but part of it is tolerably productive of grain, and about a third of it allows the successful cultivation of the vine. It is famous for its manufactures of paper, and has several mines of iron ore and antimony. Besides the Charente, which is noted for its winding course, this department is watered by the Louvre and the Boutonne, both of which run into that river, the former at Angoulesme, and the latter two leagues to the east of Rochefort.

Angoulesme, the capital of the department, is an ancient city, seated on a mountain surrounded with rocks, but indifferently defended by a castle and the remains of a wall; it is an episcopal see, containing twelve parishes and two abbeys. The inhabitants are computed at 14,000, and its chief manufactures are coarse cloth and paper. It lies 23 leagues south-east of Rochefort. The ancient name of this town was Iculisma, or Iculisna, but it is little noticed in history.

Cognac, famed for its brandy, vulgarly called Coniac, is only a small town, containing about 3000 inhabitants, seven leagues westward of Angoulesme. It stands in a fruitful and agreeable country, watered by the Charente, and is defended by a castle. Here Francis I. was born, and several councils were held.

Barbezieux, about five leagues south-east of Cognac, and 45 miles north-east of Bourdeaux, contains nearly 2000 inhabitants, and is noted for its mineral spring and a manufacture of linen cloth. It is pleasantly situate in a picturesque country.

Confolens and Ruffec, are small towns in the northern extremities of the department.

Jarnac is a market town on the Charente, about 20 miles west of Angoulesme, on the road to Cognac. The protestants were defeated by the duke of Anjou, afterward Henry III. in 1569, near this place.

CHARENTE, INFERIEURE, or Lower, a department in France, comprising part of the province of Saintonge and Aunis. It is about 40 French leagues long, and more than 20 broad, contains 366 square leagues of territory, and upwards of 400,000 inhabitants. It is a maritime district, lying between Charente and the bay of Biscay, and is divided into six circles, viz. Rochelle, Rochefort, St Jean d'Angely, Saintes, Jonzac, and Marennes, besides the islands of Re and Oleron. The soil of this department is generally good, and yields grain and fruits in abundance, but that part which borders on the ocean is considered unhealthy. It has several mines, and some medicinal springs. Its manufactures and articles of trade are similar to those of Charente.

Saintes, the capital, anciently called Mediolanum Sanctorum, 14 leagues west of Angoulesme, also on the Charente, is a badly built town, containing 10,000 inhabitants. It has a noble cathedral, and is rich in monuments of ancient grandeur. Of these the most remarkable are an aquæduct, an amphitheatre, and a triumphal arch.

Rochelle, a fortified sea-port, containing nearly 20,000 inhabitants, is more than 200 miles south-west of Paris. It is neatly built, but stands in a marshy situation, has a good harbour, tolerably well defended, and carries on a considerable trade in wine, brandy, paper, and linen. It is a bishop's see, and has an academy of sciences. Rochelle was the chief town possessed by the reformed in the 16th century, and was strongly fortified by them. But it was taken in 1628, after a tedious and difficult siege. Its reduction proved the death-blow to their cause in France, as there then remained no security against the power and malice of their opponents. Its fortifications, which had been destroyed, were afterwards repaired by the celebrated Vauban. The old name of this city was Portus Santonium.

Rochefort, a sea-port, 15 miles from the mouth of the Charente, and 18 south south-east of Rochelle, is strongly fortified, possesses a military arsenal and magazines, and contains 15,000 inhabitants. It was at one time reckoned unhealthy, but this remark does not apply to it since the draining of the marshy lands in its vicinity. Rochefort is quite a modern town, having been founded by Louis XIV. about the middle of the 17th century.

St Jean d'Angely, 32 miles south east of Rochelle, was once an important town, but has dwindled in recent times, and now scarcely contains 6,000 inhabitants. It is seated on the Boutonne, and is famous for its brandy. A Benedictine abbey was founded here in the 8th century. This is one of the places formerly in the hands of the protestants, who contributed greatly to its prosperity. Its fortifications were demolished in 1621.

Jonzac, is a small place to the west of Barbezieux.

Marennes, is a sea-port, containing about 5,000 inhabitants, situate in a marshy tract opposite the isle of Oleron. It is noted for a particular species of oyster, and trades pretty extensively in grain and salt.

Marans, a market town, 12 miles north-east of Rochelle, has a good trade in similar articles.

Pons, an inland town, 10 miles south-east of Saintes, is well built, and contains upwards of 4000 inhabitants. It is famed for a mineral spring.

Talmont, a market town on the coast, 20 miles south-west of Saintes, has a harbour.

At *Tailleborg* on the banks of the Charente, about 8 miles north of Saintes, the English under Henry III. sustained a smart defeat in 1242. On this occasion the policy of prince Richard, brother of Henry, saved his countrymen from farther loss, by amusing the French monarch with proposals for a truce, till they made good their retreat. About four thousand English were taken prisoners, and Henry himself owed his safety to the speed of his horse.

The island of *Re* or *Rhe*, which lies near the coast of this department, opposite Rochelle, is about 16 miles long and four broad. It contains about 18,000 inhabitants, and carries on a brisk trade in wine, brandy, and a liquor called aniseed water.

St Martin, its capital, is pretty well fortified, and has a tolerable good harbour.

Oleron, opposite the mouth of the Charente, is a populous and fruitful island, 14 miles long and five broad. Its chief products are grain and wine. It contains five or six towns and several villages. Part of the island is fortified by art, and most of the remainder is protected by the ruggedness and abrupt character of the coast. Oleron at one period belonged to the crown of England, and gave name to the famous code of laws promulgated by Richard I. on his return from captivity in Germany, the greater part of which still regulates the maritime affairs of Europe. These laws, forming 47 heads or chapters, are printed in Godolphin's *View of Admiralty Jurisdictions.* See Anderson's *History of Commerce*, vol. i. page 179. The ancient name of this island was Uliarius.

The small island of *Aix*, lies between Oleron and the continent, and has a fort which protects the entrance into the Charente. It is 12 miles north-west of Rochefort.

CHARLESTOWN, the capital of the state of South Carolina in America. See CAROLINA, SOUTH.

CHART, a hydrographical map, or a projection of some part of the earth's surface, particularly constructed for the use of mariners. See GEOGRAPHY.

CHARTA, in its original meaning, denotes a kind of paper made of the Egyptian Papyrus or Biblus, but signifies also a charter or deed in writing. Magna Charta, or the great charter, is so called from being the great charter of the liberties of England, and the foundation of her laws and privileges. This charter may be said to derive its origin from Edward the confessor, who granted several privileges to the church and state. These privileges were confirmed by Henry the First, and they were farther confirmed or re-enacted by Henry II. and King John, in whose reign the present Magna Charta was obtained.

CHARTRES, a city of the department of the Eure and Loire in France, stands on the river Eure, and is remarkable for the spires of one of the churches, one of which is admired for its magnitude, and the other for the beauty of its ornaments. The population is stated at 15,000, and a great deal of woollen stuffs are manufactured in the neighbouring villages.

CHARYBDIS, a whirlpool in the straits of Messina, between Naples and Sicily, and opposite to Scylla, a rock on the coast of Italy, and frequently alluded to by the ancients. The dangers of the navigation, arising from the whirlpool and the rock, have given rise to the proverb, Avoiding Charybdis he falls on Scylla; which is expressive of the risk of encountering one evil by shunning another.

CHATHAM, a town of Kent in England. See KENT.

CHATTERTON, THOMAS, an English poet, who acquired considerable notoriety by a species of literary fraud, was born at Bristol in the year 1750, and was the posthumous son of the master of a free school in that city. It is said he made slow progress in acquiring even a knowledge of the letters of the alphabet, till he met with the illuminated capitals of an old manuscript. In his 8th year he began to attend a charity school, where he was instructed in reading, writing, and arithmetic. Soon after this period he discovered a strong desire for reading, and before he was 12 years of age it is said that he had perused 70 volumes, chiefly on subjects of history and divinity. At this time, too, he had begun to make verses, and his deportment was distinguished by unusual gravity, and even some tincture of melancholy. In his 15th

Chatterton. year he was bound apprentice to a scrivener, and he employed his leisure hours in transcribing old English glossaries and in studying heraldry.

The opening of a new bridge at Bristol in 1768, forms a remarkable era in the life of Chatterton, for at that time a paper appeared in a Bristol journal, containing a description of the friars first passing the old bridge; and this paper was professed to be extracted from an old manuscript. This production, which excited great attention, was traced to Chatterton, and threats were used to induce him to declare from what source he obtained it. Evasive or contradictory explanations were given; and it was at last asserted, that the paper was found in a chest in Redcliffe church in Bristol. This church was erected or rebuilt in the 15th century, and six or seven chests had been deposited in it. In the year 1727, one of these chests was broken open by authority, the keys being lost, and some title-deeds were removed, but some manuscripts were left. The father of Chatterton, who had been at one period a singer in the cathedral, carried away many of the parchments, and among them the young man pretended that he had discovered the poems which he presented to the public under the name of *Rowley*, a priest of the 15th century. About this time Chatterton was known as a contributor to the Town and Country Magazine, both in prose and poetical compositions; and while he succeeded in imposing on the credulity of some the productions which were brought forward as ancient poems, the knowledge of his talents convinced others that they were to be ascribed to himself as the real author.

The flattering reception which these productions, whether they are to be considered ancient or modern, obtained in his native city, induced him to address a letter to the Honourable Horace Walpole, accompanied with specimens of the poetry of Rowley, and offering to furnish him with some account of ancient painters of eminence at Bristol. The poems were pronounced to be forgeries by those who examined them; and an attempt of Chatterton to renew the correspondence with Walpole failed. The neglect which he experienced from Walpole, whether it arose from the impression of imposition relative to the poems, or from some other cause, drew forth from Chatterton some severe reflections against the latter, who afterwards found it necessary to publish a vindication of himself.

The details of business were ill suited to Chatterton's pursuits and habits, and the disappointment of his sanguine expectations, or the natural melancholy of his temper, threw him into despair, and even produced threats of destroying himself with his own hand. He was dismissed by his master, and, encouraged by the hope of literary employment in London, he visited the metropolis when he was little more than 17 years of age. For some time after his arrival, which was in the month of April 1770, he exhibited no small degree of industry in furnishing communications to the ephemeral pages of the various publications of the day. But the emolument derived from these exertions of his genius was not equal to his expenditure; he was soon reduced to the extremest indigence, and, oppressed with poverty and disease, in a fit of despair he put an end to his existence by swallowing poison. He died in August 1770, before he had reached the 18th year of his age.

Chaucer. With great powers of genius, Chatterton was remarkable for a violent and impetuous temper. His biographer says, that "he possessed all the vices and irregularities of youth, and that his profligacy was at least as conspicuous as his abilities." In the year 1777, were published in one volume, octavo, *Poems, supposed to have been written at Bristol, by Thomas Rowley and others, in the 15th century*, with an engraved specimen of one of the manuscripts; and in the succeeding year, appeared a similar volume, which was entitled, *Miscellanies in Prose and Verse*, by Thomas Chatterton, the supposed author of the poems published under the names of Rowley, &c. No subject ever excited a keener controversy than the authenticity of these poems, which was defended by the learned Jacob Bryant and by Dr Milles, dean of Exeter, while it is strenuously disproved by Mr Walpole, Mr Warton, Mr Tyrwhitt, and some anonymous writers. The more general belief now is, that they are the production of Chatterton himself, however extraordinary it may appear that they must have been composed before he was 16 years of age.

CHAUCER, Sir Geoffrey, the father of English poetry, was born in London in the year 1328, but of the course and place of his education no authentic record remains. Some have supposed that he prosecuted his early studies at Cambridge or Oxford, while others assert that he was educated in France, and after his return that he resided some time in the Temple to acquire a knowledge of the municipal laws of England. But it appears from the contradictory statements of his biographers, that the events of his early life are veiled in obscurity. It is supposed that Chaucer had nearly reached the 31st year of his age, before he was fortunate in attracting the notice of Edward III. and of securing the patronage of John of Gaunt, who continued afterwards to be his steady friend; and, about the same time or soon after, he had a residence near the palace of Woodstock. When Chaucer was in his 39th year, he received from Edward III. a pension of 20 merks per annum, a sum equal to L.200 of the present day; and five years afterwards he seems to have acquired a character of some political importance, when he was appointed king's envoy to Genoa. This appointment, and his interview with the poet Petrarch, while he was in Italy, have been also the subjects of controversy. Besides some other favours, he was promoted to the comptrollership of the customs of wool and skins in the port of London, was presented by the crown with a daily allowance of a pitcher of wine, which was commuted in the succeeding reign for an annuity of 20 merks, and enjoyed during the whole period of Edward the III.'s reign and John of Gaunt's influence an uninterrupted course of prosperity. But in the time of Richard II. the successor of Edward, the poet seems to have been involved in a dispute between the court and the city of London, and Chaucer seems to have taken part with the latter, the consequence of which was, a temporary exile to the continent, and imprisonment in the tower when he returned to England, and it is said that he obtained his liberation by a confession not very honourable to his memory. The return from Spain into England in 1388, of John of Gaunt, who was now duke of Lancaster, and afterwards married the sister-in-law of the poet, was an era peculiarly favourable to the fortune of Chaucer. In the next year he was promoted to lucrative official situations; and when he had reached the 63d year of his age, he retired in some degree from public life, and it is supposed resumed his residence at Woodstock, where he was chiefly engaged in the composition of his *Canterbury Tales*.

When Henry IV. the son of his patron, John of Gaunt, ascended the throne of England, some of the grants and pensions of which he had been deprived, or which he had voluntarily relinquished in the preceding reign, were restored to Chaucer, but he lived only a short time to enjoy the munificence of his royal relative. He died in October, in the year 1400, which was the commencement of the second year of the reign of that monarch, and was interred in Westminster abbey, where, 150 years afterwards, a monument was erected to his memory by Nicholas Brigham, a gentleman of Oxford, and a warm admirer of his poetry.

Chaucer was not only the first, but also one of the best English poets. He was great in every kind of poetry, and displays every kind of excellence, excepting melody and accuracy of measure, defects which are to be ascribed to the imperfect state of the language and the infancy of the art, rather than to deficiency of talent or want of genius. "As he is the father of English poetry," says Dryden, "so I hold him in the same degree of veneration as the Grecians did Homer, or the Romans Virgil. He is a perpetual fountain of good sense, learned in all sciences, and therefore speaks properly on all subjects. As he knew what to say, so he knew also when to leave off, a continence which is practised by few writers, and scarcely by any of the ancients, except Virgil and Horace." *The Court of Love*, which was the earliest production of the poet, was composed when he was only in his 18th year. The story of *Troilus and Cresseide* was the next offspring of his genius, but although the names and scenery refer to classical antiquity, the sentiments and manners are connected with modern and chivalrous times. Many of Chaucer's poems, as the *Dream*, the *Boke of the Duches*, the *Romaunt of the Rose*, the *Flower and the Leaf*, and *the House of Fame*, are drawn up in the form of allegory. But the *Canterbury Tales*, the finest production of his muse, are alone sufficient to transmit his name to posterity. The plan of that work is borrowed from the *Decameron* of Bocaccio, and the subject is the journey of some travellers on a pilgrimage to Canterbury, who engage to entertain each other with stories by the way, and he who tells the best story is to be treated with a supper at the joint expence; and in his delineation of character he is not considered inferior to Shakespeare himself. The Canterbury Tales of Chaucer were first printed by Caxton, and the first collection of his works was published in one folio volume, by William Thynne, London, 1542. They have been several times reprinted, and an elaborate life of the poet has been drawn up by Mr Godwin.

CHEIRANTHUS, Stock Gilly-Flower, or Wall-flower, a genus of plants belonging to the Tetradynamia class.

CHELIDONIUM, Horned or Prickly Poppy, a genus of plants belonging to the Polyandria class.

CHELMSFORD, the capital of Essex in England, contains more than 4000 inhabitants, and has in its vicinity two extensive barracks, which are capable of accommodating 4000 troops.

CHELONE, a genus of plants belonging to the Didynamia class.

CHELTENHAM, a town of Gloucestershire in England, which includes, with the parish, more than 8000 inhabitants, and is chiefly celebrated on account of its mineral waters, which attract numerous visitors during the summer season.

CHEMISTRY.

Introduction.

When certain bodies are brought into contact, so that they shall act on each other, certain changes, some of which are very remarkable, invariably follow. These changes will be best illustrated by a few simple experiments.

Exper. 1.—An infusion of violets or red cabbage, which affords a blue colour, is prepared by the addition of boiling water to the vegetable substance, and allowing it to remain for some time to extract the colouring matter. If to a portion of this blue infusion, a few drops of spirit of hartshorn of the shops be added, a beautiful green colour is produced; but if a little vinegar be added to another portion of the same blue infusion, it is converted into a fine red colour; and hence blue vegetable infusions are employed as convenient tests of acid and alkaline substances.

Exper. 2.—If to a solution of green vitriol, sulphate of iron of modern chemistry, an infusion of nut galls, which are both nearly colourless and transparent, be added, the mixed liquids become of a deep black colour. Common writing ink is the product of this mixture.

Exper. 3.—If to the same solution of green vitriol, a solution of prussiate of potash be added, the liquid becomes cloudy, and a matter of a rich blue colour falls to the bottom. The substance thus produced is Prussian blue.

Exper. 4.—If to a solution in water of the well known substance sugar-of-lead, a small quantity of oil of vitriol or sulphuric acid be added, a white

Introduction.

cloud is formed in the mixture, and a copious precipitate is produced.

Exper. 5.—Reduce a small quantity of common pit coal to a coarse powder, and introduce it into the bowl of a tobacco pipe, cover it up with a little moist clay, when it is dry expose it to heat in the open fire, and when it has become red hot apply a light to the end of the tube, a particular kind of air, or gas in the language of chemistry, will continue to burn for some time. The air thus produced is familiar to every one in the gas lights.

These experiments will enable the student to form a more distinct notion of the nature of chemistry than any definition which has been yet proposed. It is the object of chemistry to investigate the changes which are produced by the action of certain bodies on each other, to discover in what circumstances those changes take place, or the laws which are observed during the process, and to examine the result which is obtained. This science, therefore, is occupied in tracing the nature, laws, and result of the changes now alluded to.

In all the changes which are produced by the accession or abstraction of heat or light; in all the changes which are produced by the combination of two bodies, and the formation of a new compound, chemical action appears. Considering then the multifarious changes to which the bodies in the material world are constantly subject; considering the diversified nature and endless variety of forms which those bodies by every new change exhibit, and considering the astonishing results obtained by the most simple means, which appear in the compounds produced, it is obvious that the sphere of chemical action is wide and extensive, and indeed is only limited by the bounds of the material world itself. For wherever the effects of light and heat are felt, few, or perhaps no kinds of matter, even those which seem the least susceptible of change, are exempted from their influence.

By what means are the wonderful changes which appear on the return of spring, accomplished,—when nature emerges from the gloom and rigour of winter,—when the vegetable tribes resume their verdure, when the buds unfold their leaves,—when the flowers display in gay profusion a thousand various hues, delight the eye with endless beauty, and fill the air with fragrant perfume? Or to what is to be ascribed the maturing influence of summer, diffusing joy and plenty around? These astonishing effects, for so we should consider them if they were less familiar, are owing to the operation of heat, one of the most powerful agents, or rather to the united operation of light and heat. But their effects not confined to the vegetable creation. Myriads of animals, whose vital functions had been suspended, are invigorated by the same powers, and restored to a new existence; the air, the earth, the waters, swarm with life; every leaf has its inhabitants; every tree is peopled with innumerable living tribes.

In examining the nature, properties, and constitution of the atmosphere, the aid of chemistry is essentially requisite; in the extraction of metals from their ores, and in converting them to the numerous purposes to which they are applied in civilized society, almost all the processes are chemical;—in investigating the nature, functions, and uses of vegetables, whether in the living or dead state;—in acquiring a knowledge of the functions and properties of animals;—and in the application of many parts both of vegetable and animal matter to a thousand valuable purposes, chemistry furnishes the principal means; and hence it must be an important guide in agriculture, as it has been long regarded as a material branch of medical education.

The application of chemistry to the improvement of the arts of civilized life, opens a wide field of contemplation. In many of these arts, as in the manufacture of glass and porcelain, in tanning, soapmaking, dyeing, bleaching, baking, brewing, distilling, and in most of the culinary arts, almost all the processes depend on chemical principles; and it may be added, that there are numerous little processes in various branches of domestic economy, where even a slight knowledge of chemistry may often prove highly useful. But without extending farther these preliminary remarks on the utility and advantages of chemistry, the following exposition of its principles and practice, will afford abundant proof of the importance and universal application of the science.

This treatise is divided into three parts. Part I. is devoted to an explanation of the principles of chemistry; in Part II. the phenomena of nature will be illustrated according to these principles; and Part III. comprehends a rapid sketch of the processes of art, or of some of the principal arts and manufactures which depend on chemistry.

PART I. PRINCIPLES OF CHEMISTRY.

Exclusive of light and heat, the bodies which constitute the elements of chemical investigation, are oxygen gas, azotic gas, hydrogen gas, carbone, phosphorus, and sulphur; three alkalies, nine earths, and twenty-seven metals; and if to this number be added chlorine, with the bases of fluoric and boracic acids, the subjects of later discoveries, the whole will amount to forty-eight. In treating of these bodies, the simple and most natural arrangement is to examine them according to the simplicity of their constitution, and their importance as chemical agents; and in investigating the properties of any body, its habitudes and combinations with those which have preceded, will be particularly detailed. In this way much anticipation is avoided; and while the science is fully illustrated, all theoretical views, on which peculiar methods of arrangement are constructed, are excluded. But before proceeding to the examination of individual substances, it is necessary to be acquainted with the properties and effects of light and heat, which have so large a share in all combinations and decompositions; and it is even requisite that this knowledge be preceded by a brief enquiry into the nature of those circumstances in which these decompositions and combinations are effected, or of the laws of affinity. These topics will form the subjects

Affinity.

of the first two chapters, and the others will follow in the order in which they have been enumerated.

Chapter I. Of Affinity.

All bodies in nature are attracted or drawn towards each other by a certain force. It is a familiar fact, that a stone when it is unsupported falls to the ground; the planets which revolve round the sun are attracted by that luminary as their centre of motion; polished surfaces of marble, glass, or metal, adhere together, and require for their separation a considerable force; a piece of wood or stone cannot be broken or drawn asunder without powerful exertion; and lime and sulphuric acid enter into such close combination, as not to be separated without a great degree of force. Whatever be the nature of these attractions, whether they are to be ascribed to the same universal power or property pervading all matter, they have been distinguished by different names. The attraction existing among the heavenly bodies was denominated by Sir Isaac Newton by the general term *attraction;* and he proved it to be the same as gravitation, or the descent of heavy bodies towards the earth;—that it is an essential property of all matter;—that the minutest particles, in proportion to their bulk, as well as the largest masses, are equally under its influence;—and that the same power which retains the planets in their orbits, gives a globular form to the drops of rain. That attraction which keeps polished surfaces in close contact is called *adhesion;* when particles of matter of the same nature are held together or attracted, the expression of the force by which this is effected is denoted *cohesion, homogeneous affinity,* or the *attraction of aggregation*; but when particles of a different nature enter into combination, the force or attraction is denominated *heterogeneous affinity,* the *attraction of composition,* or more properly *chemical affinity.*

Sect. I. *Of Adhesion.*

That force which retains different substances in contact with each other, is called *adhesion.* It takes place either between two solids, as marble or glass, or between solids and fluids, as glass and water. When the finger is brought into contact with water, the latter adheres to it, or the finger is said to be wet; and a strong attraction exists between gold and mercury.

Two plates of glass of one-tenth of an inch in diameter, required a force equal to 19 oz. to separate them; and a polished plate of glass being suspended from the arm of a balance, and placed in contact with a surface of mercury, nine grains were necessary to separate the two surfaces; and the whole apparatus being placed under the receiver of an air pump which was exhausted of the air, exactly the same force was found requisite to produce the separation of the surfaces. The last experiment shews clearly that the adhesion of the two substances was not owing to the pressure of the air, but to the attraction between themselves. When the same disk of glass was brought into contact with pure water, it adhered with a force equal to 258 grains, and to the surface of a solution of potash with a force equal to 210 grains.

In some curious experiments on this subject by Morveau, plates of different metals, an inch in diameter, and of equal thickness, quite round and well polished, were prepared. To keep them suspended parallel to the horizon, each plate was furnished with a small ring in the centre, and this being connected with the arm of a delicate balance, it was exactly counterpoised by weights in the opposite scale. The plate was then applied to the mercury by sliding it over its surface to exclude the air, and weights were added in the opposite scale, till the adhesion between the plate and the mercury was broken. From the result of these experiments it appeared that gold adheres with a force equal to 446 grains, silver equal to 429 grains, tin equal to 418 grains, lead equal to 397 grains, copper equal to 142 grains, iron equal to 115 grains, and cobalt equal to 8 grains only.

This investigation was farther prosecuted by Achard of Berlin, who made a great number of experiments on the force of adhesion between disks of different solids, as glass, rock-crystal, sulphur, wax, horn, and metals, with water and other fluids, at different temperatures. A glass disk of one inch and a half in diameter, was found to adhere to the surface of water at the temperature of 141°, with a force equal to 81 grains; at the temperature of 95°, with a force equal to 89 grains; and at the temperature of 43°, with a force equal to 97 grains. From these results it appears that the force of adhesion is diminished by the diminution of the temperature.

Sect. II. *Of Cohesion.*

When particles of the same kind of matter are united, the force with which they are held together is called cohesion, or the attraction of aggregation, or homogeneous affinity. This force is probably of the same nature with that of adhesion, but different in degree. A greater force is necessary to separate the particles of a mass of marble than two polished surfaces of the same matter when they are brought into contact.

The force of cohesion is very different in different bodies. A great force is requisite to overcome the power of cohesion among the particles of a wire of gold, or of iron, but a small degree can separate the particles of a piece of wood or stone. A series of experiments was instituted by Muschenbroeck to ascertain this force. Rods of an inch square, of the different substances examined, were suspended perpendicularly, and the amount of the weight necessary to destroy the cohesive force of the particles being attached to the lower extremity of the rods, was considered as the measure of that force. Among the metals, a bar of steel required 135,000 pounds to break it; a bar of iron 74,500 pounds; a bar of cast gold 22,000 pounds. Among the alloys of the metals, gold two parts silver one part, 28,000 pounds; copper six parts, tin one part, 55,000 pounds; brass 51,000 pounds. Among the woods, a rod of the locust tree, 20,100 pounds; beech and oak 17,300, pounds; pitch pine 7,656 pounds; among bones, ivory 16,270 pounds; horn 8,750 pounds; and whalebone 7,500 pounds.

All bodies in nature exist in three different states, which are quite distinct from each other; in the form of solid, liquid, and in that of elastic fluid. The diversity which exists among solid bodies, arises no doubt from the various degrees of cohesive force among the particles of which they are composed. It is the peculiar property of fluids to admit of free motion among their particles by the application of any force. In liquids, as water or mercury, an attractive power exists; but in elastic fluids, as air, a repulsive power, which is increased or diminished by changes of temperature, is a characteristic property; or perhaps it should rather be said that the force of affinity between the particles of elastic fluids is extremely weak, and is therefore more sensibly influenced by the slightest changes of temperature.

Solution.—The force of cohesion between the particles of many solid bodies, is less strong than the affinity which exists between the same particles and certain liquids; thus, if a portion of common salt be introduced into water, the affinity between the particles of the salt, which were collected together in masses in the form of cubes, is overcome by the stronger affinity of the same particles for the water. This process is well known in familiar, as well as chemical language, by the name of *solution.* But this affinity between the water and the salt has also its proper limits, a certain proportion can only be dissolved, and if more be added it falls to the bottom unchanged. In many cases, a larger portion of saline matters, even to double the quantity, is dissolved in boiling water, than in the same liquid at the ordinary temperature of the atmosphere. Whatever be the proportion of the solid body dissolved, it is equally diffused throughout the whole mass of liquid, which remains as transparent as before the addition of the saline matter; and when the quantity of liquid is diminished, the particles of the dissolved body are brought nearer together, so that the power of affinity resumes its action, and they are restored to the solid form. In those cases in which the increased temperature of a liquid enables it to dissolve a larger proportion of salt, when that temperature is diminished the cohesive force between the particles of the salt and the liquid is weakened, while the affinity between the particles and the salt begins to act, and it becomes solid.

Crystallization.—The diminution of the mass of liquid in which any saline body is dissolved, whether it be effected at the ordinary temperature of the atmosphere, or by the application of artificial heat, is called *evaporation*; the process by which the saline substances return to the solid form is called *crystallization*; and the same bodies when dissolved in the same liquid, and treated in the same way, invariably assume the same form.

No bodies can assume the form of crystals, excepting those which can be reduced to the state of fluid. But many substances which are not soluble in any liquid, assume regular forms, as is the case with glass, sulphur, and metallic substances, which are brought to the state of fusion by combining with heat, and the particles being separated from each other, or the affinity of aggregation being destroyed, they are left at liberty to arrange themselves into determinate forms, or to crystallize.

Many of those saline substances which arrange themselves in certain determinate forms, combine with a considerable portion of water, which, in such cases, constitutes part of the solid; and to this water, which is called the water of crystallization, as well as to the uniform distribution of the particles of the salt themselves, is no doubt owing the transparency of many crystalline bodies.

Efflorescence and Deliquescence.—Some salts which form crystals from solution in water, when they are exposed to the air readily part with their water of crystallization; this process is called *efflorescence*; and it is owing to the weak affinity between the particles of the salt and the water which had combined with it during its crystallization. As this process proceeds, the surface of the crystallization loses its polished appearance; it becomes dull and opaque, and at last the whole falls down into powder. Very opposite effects take place on other salts when placed in the same circumstances; instead of giving out moisture, they attract it from the atmosphere, and some of them in such quantity as in a very short time to be reduced to the state of liquid. Of the first kind, or efflorescent salts, soda, and its combination with sulphuric acid, forming common Glauber salt furnish good examples; and of the second kind, or the deliquescent salts, potash, or muriate of lime, is an equally appropriate instance.

In conducting the crystallization of salts, it is an object to have them in the most perfect form, and of a large size, that the form may be distinctly seen. This branch of practical chemistry has been successfully cultivated by M. Leblanc, and the results of his experiments and observations have been published in a memoir *Jour. de Physique*, 55.300. The process must be conducted in flat-bottomed vessels of glass or porcelain, and they should be kept at perfect rest; the salt must be in a state of purity, and it is necessary to attend to the degree of specific gravity at which the solution begins to form crystals. If the specific gravity, or the quantity of salt, be too great, the crystals which are formed are heaped together in confused masses; and no crystals are obtained when the specific gravity is too small, or the solution too weak. When the solution which is of sufficient strength has been allowed to cool slowly, a small number of crystals is obtained. These crystals have no other defects than what arise from their contact with the vessel, and sometimes perfect crystals are found among them. These more perfect crystals are to be separated from the rest, and by changing their position in the solution daily, they may be obtained in the completest form, and of the largest size. For this purpose, new solutions of the same salt are prepared, and being brought to that degree of concentration which affords crystals in a mass, this mass being removed, the single crystals are introduced, either by disposing them in the vessel, and pouring on the solution, or after the latter is put into the vessel, and distributing the crystals on the bottom. All that is necessary for promoting the increase and perfection of the crystal is the frequent change of its position, keeping up the solution to a proper degree of strength, and allowing it to remain at perfect rest during the process. When the crystals are left too long in the solution, or when the solution is too weak when they are introduced, instead of increasing in bulk they begin to diminish, and are partially dissolved. This may be known by the edges, or angles, becoming less sharp.

Forms of crystals.—The regular forms which many bodies assume, either in the process of nature or in artificial solutions, could not fail to attract the attention of naturalists and chemical philosophers. The investigations of Bergman and Romé de L'Isle, and more lately the researches and speculations of the Abbé Hauy, have been particularly directed to this curious subject.

According to the ingenious theory proposed by the Abbé Hauy, the integrant particles always combine in the same way; they unite by the same faces, or the same edges, but these faces and edges are different in different crystals. Whatever variety of forms the same substances assume during crystallization, they all contain a nucleus, or primitive form, which may be extracted by careful mechanical division. In the examination of crystals, Hauy found that all the primitive forms might be reduced to six, namely, 1. the *parallelopiped*; 2. *tetrahedron*; 3. *octohedron*; 4. the *regular six-sided prism*; 5. the *dodecahedron*, with equal rhombs; 6. the *dodecahedron*, with triangular faces, composed of two six-sided pyramids, united base to base.

But it was found by the same philosopher, that the nucleus, or primitive form of a crystal, is not the last term of its mechanical division, for it may be subdivided not only parallel to its different faces, but sometimes also in different directions. In those cases where the primitive form is a parallelopiped, which is unsusceptible of subdivision, excepting in a direction parallel to its faces, it is obvious that the *integrant particle*, or *molecule*, the denomination given by Hauy to the last term of the mechanical division of a crystal, must be similar to the nucleus itself. Guided by experiment, he has reduced the integrant particles of all crystals to the three following figures: 1. the tetrahedron, or the simplest of all pyramids; 2. the triangular prism, or the simplest of all the prisms; 3. the parallelopiped, or the simplest of the solids having their faces parallel.

From these primitive forms the author supposes that the difference of size, proportion, and density of the different particles of bodies may account for all the differences of affinity which take place in simple aggregation and composition. In the formation of primitive crystals the integrant particles unite, sometimes by their faces and sometimes by their edges, thus giving rise to the different figures of the primitive crystals which are composed of integrant particles of the same form. But in the crystallization of bodies the same primitive form is not always exhibited; the deviations from this form, and the variety of crystals thus produced, are called by Hauy secondary forms, in some cases; for example, the primitive form is the octohedron, but in deviating from this form certain salts during crystallization assume that of the cube or dodecahedron.

Pursuing this theory, the primitive form and that of the integrant molecule being determined, the laws according to which the molecules are combined to produce around the primitive form those kinds of coverings which terminate so regularly, and from which figures so different from each other, although originally of the same substance, are produced, are next to be investigated. From examining the mechanism of the structure of crystals subject to these laws, that all the parts of the secondary crystal superadded to the nucleus are formed of *laminæ* or plates which decrease regularly by subtractions of one or more ranges of integrant molecules, so that theory determines the number of these rows, and consequently the form of the crystal. The various secondary forms depend on decrements at the edges or the angles, intermediate decrements, and mixed decrements. But for a full view of the theory, and its curious details, the reader is referred to the author's *Traite de Mineralogie*, vol. i.; or to *Annales de Chimie*, vol. xvii.

Sect. III. *Of Chemical Affinity.*

Chemical affinity, or what is otherwise called the attraction of composition, takes place between the particles of different kinds of matter; and the result of this combination is a new compound, different in its properties from the ingredients of which it is composed. This difference in the properties of the compound obtained from the combination of two substances, may be considered as the character of chemical affinity.

This affinity does not exist between the particles of all kinds of matter. No action takes place between the particles of a piece of marble and water; but if a portion of muriatic acid be added, the marble is dissolved, and a uniform transparent liquid is obtained.

It is the peculiar characteristic of chemical affinity that the compounds formed by the combination of two substances have new properties different from those of their constituent parts. In some cases two mild and insipid substances afford a compound which is highly acrid and corrosive, and the combination of two very corrosive substances presents a mild and insipid compound.

Changes of colour.—Lead which is of a bluish white colour, when it combines with oxygen becomes of a bright yellow or red; the metal called cobalt is of a grey colour, but assumes a fine blue when combined with oxygen; and copper, which is red, when combined in the same way presents a green colour.

Changes in smell.—The smell of ammonia or volatile alkali is extremely pungent; the smell of muriatic acid is still more pungent; but when the two are united, the compound formed, which is sal-ammoniac, is perfectly inodorous. No example, indeed, can be given, which affords a better illustration of the effects of chemical combination, in which two highly volatile substances become fixed in the compound, and exhibit an entire change of their most obvious properties. In the uncombined state the smell of sulphur or of potash is scarcely perceptible; but if they are fused together into a mass and moistened with water, a very offensive odour is exhaled.

Changes in taste.—Sulphur is nearly insipid, and oxygen, which is one of the constituent parts of the atmosphere, is not only innocent, but essentially necessary for the support of animal life; but when the two bodies enter into combination, the compound thus formed, which is oil of vitriol or sulphuric acid, is well known as one of the most corrosive substances. Sulphuric acid, which is sour and corrosive, when combined with soda, which in its pure state is also of a corrosive quality, forms a compound of a bitter nauseous taste, having none of the properties of its component parts. The new compound is Glauber salt, or sulphate of soda.

Changes in constitution.—The effects of chemical action in changing the constitution of bodies, are not less remarkable. Water in the solid state, or ice, when combined with heat becomes a transparent liquid; and this liquid having entered into combination with a larger portion of heat, assumes the form of vapour, which is an invisible elastic fluid. A large portion of water disappears when it is thrown on newly burned lime; part flies off in the state of vapour, but part enters into combination with the lime and becomes solid. Ammonia, or volatile alkali, in the state of elastic fluid or gas, is equally invisible with common air; muriatic acid gas is also transparent and invisible; but when they are united, a white solid substance, or sal-ammoniac, is the result.

Many of the most important operations in chemistry depend on the different force of affinity which exists between different bodies. Two kinds of affinities have been described and distinguished by the names of *simple* and *compound*, or, as it is sometimes expressed, simple elective attraction, and double elective attraction. The word elective was used to signify a choice or preference which one body had for another.

Simple affinity.—This kind of affinity includes all those combinations which take place between two bodies without the intervention of others, as when an acid and an alkali combine together when they are brought into contact.

Experiment 1.—To a quantity of muriatic acid add small bits of marble, till the effervescence ceases. This is an example of simple affinity. The marble consists of lime and carbonic acid; but the muriatic acid, having a stronger affinity for the lime than the carbonic acid, combines with it, and the carbonic acid being set free, passes off in the state of gas, which is the cause of the effervescence.

Exper. 2.—Introduce into a retort a portion of the salt called acetate of soda, which is a compound of acetic acid and soda, add some muriatic acid, and apply heat till the whole is reduced to a dry mass. The muriatic acid having a stronger affinity for the soda, combines with it, and the acetic acid is driven off.

Exper. 3.—Add a quantity of nitric acid to the dry mass in the retort, which is muriate of soda, and apply heat, the muriatic acid will be separated and pass off in the state of gas, and the nitric acid unites with the soda.

Exper. 4.—The dry mass remaining in the retort is a compound of nitric acid and soda or nitrate of soda. Let a portion of sulphuric acid be added and heat applied, the nitric acid will be driven off, and the sulphuric acid will combine with the soda.

These experiments are all cases of simple affinity, and in the last three the muriatic, nitric, and sulphuric acids being successively brought into contact with the several compounds of the soda, unite with it in consequence of the superior force of affinity. These changes of affinity are sometimes represented by diagrams, as in the following example of simple affinity.

Muriate of soda. { Muriatic acid
20
Soda 25 sulphuric acid.

Sulphate of soda.

When it is an example of simple affinity, as in this case, a single bracket is employed. The substance to be decomposed is placed on the outside, and the name of the new compound, which is the sulphate of soda, is placed below the lower horizontal line; the constituents of which it is composed above the same line, and the name of the substance which is driven off is placed below the upper horizontal line. In this case the muriate of soda is decomposed by sulphuric acid, and a new compound, sulphate of soda, is obtained, while the muriatic acid is expelled. The terms *quiescent* and *divellent* are sometimes used in speaking of the force of affinity. In this case the quiescent affinity is that which operates between the muriatic acid and the soda; and the divellent affinity exists between the sulphuric acid and the soda: and here it is obvious that no decomposition or change can take place unless the latter be greater than the former. The former of these affinities is sometimes expressed by numbers, as, in the above case, the number 20 denotes the quiescent affinity, and 25 is expressive of the divellent affinity.

Compound or double affinity.—It sometimes happens that no decomposition takes place by the addition of a third substance, in consequence of the stronger affinity already existing between the two substances in combination. Thus, the decomposition of sulphuric acid and zinc, or sulphate of zinc, cannot be effected by means of acetic acid, because the affinity of the zinc for sulphuric acid is stronger than the affinity of the zinc for acetic acid; or the quiescent affinity is superior to the divellent affinity, and therefore no change can take place. But if a fourth substance be introduced which has an affinity for one of the constituents in the compound, the quiescent affinity may be overcome, and a decomposition may be effected. Lead has a strong affinity for sulphuric acid. If, then, a solution of the compound of acetic acid and lead, or sugar-of-lead, be added to a solution of sulphate of zinc, a change is immediately produced, because the combined or divellent affinities of the acetic acid and the lead are greater than the quiescent affinities of the sulphuric acid and the zinc, and as one of the new compounds, the sulphate of lead, is insoluble in water, it falls to the bottom, or, in the language of chemistry, is precipitated. Cases of compound affinity are also represented by diagrams, of which the following is an example.

Acetate of zinc.

Sulphate	Zinc 6 acetic acid	Acetate
of	9 4	of
zinc.	Sulphuric acid 12 lead.	lead.

Sulphate of lead.

In the above diagram the names of the substances to be decomposed are placed on the right and left sides of the upright brackets, and their quiescent affinities are expressed by the numbers 9 and 4, equal to 13. The affinity of the acetic acid for the zinc is denoted by 6; but the affinity of sulphuric acid for zinc is equal to 9, and hence no change can be effected by the addition of acetic acid. But the acetate of lead being introduced, a double decomposition follows; for then the strong affinity of the sulphuric acid for the lead counterbalances the quiescent affinities, and contributes to produce the change. The sum of the quiescent affinities is equal to 13, but the sum of the divellent affinities is equal to 18; and therefore a decomposition must take place. In speaking of metallic substances, it may be observed that the name of the metal is mentioned in combination with the acid to render the explanation less complicated, instead of the oxides, which alone unite with acids.

But it has been maintained by Berthollet, an ingenious French chemist, that a decomposition may be effected by increasing the quantity of the substance with which a new compound is desired. Thus, for example, the compound of sulphuric acid and barytes is insoluble, either in hot or cold water; and sulphuric acid has a very strong affinity for the earth. Sulphuric acid has also an affinity for potash, although it is much weaker than the affinity between the same acid and barytes; but equal quantities of pure potash and sulphate of barytes being boiled together, a partial decomposition was effected. In another experiment the oxalate of lime was partially decomposed by means of pure potash, although the affinity of the oxalic acid for lime is much greater than the affinity of that acid for potash. But those who have adopted the doctrine of definite proportions explain these experiments on the supposition that a double decomposition had actually taken place, and that carbonic acid, having combined with the potash during the process, had a considerable share in the decomposition.

Definite proportions.—When a compound body, of which the constituent parts are known, invariably exhibits the same characters and the same individual properties, it is natural to suppose that the substances which enter into its composition are always in the same proportion. When certain bodies are placed in the same circumstances they acquire, by their combination, precisely the same qualities, at least as far as these qualities fall under the cognisance of our senses. This view of the elements of different kinds of matter entering into combination in the same proportions, accords with the undeviating constancy and beautiful uniformity which, when the same causes operate, are observed in all the other processes of nature which the human mind is capable of appreciating.

The ancient Greek philosophers held the doctrine that matter is composed of indivisible atoms; the same doctrine is adopted by the moderns, and it now forms a prominent feature in the more refined speculations of chemical science.

This doctrine seems to have been first started by Mr Higgins of Dublin about the year 1789. Deriving his opinion from the corpuscular philosophy, that chemical compounds have definite proportions, as atom with atom, or one with two, or three, or a greater number, he applied it to those gases which combine in more than one proportion; and supposed that all the proportions of the same element are equal. In 1802 Mr Dalton adopted the same doctrine, and extended his views to chemical compounds in general; and his views are fully illustrated in his *Chemical Philosophy*. Richter of Germany began early to prosecute the same subject, which has been followed out by some of the first chemists of Britain and France, and still farther investigated by Berzelius of Sweden.

Exper. 1.—Take one part in bulk of oxygen gas, and two parts of hydrogen gas, and let them be mixed together in a glass tube in the mercurial trough, and the tube being furnished with apparatus for passing the electric spark through it, if the gases be inflamed they entirely disappear, and nothing remains but a small portion of water.

Exper. 2.—But if two parts of oxygen, and two of hydrogen, by bulk, be treated in the same way, one part of oxygen remains uncombined; and in whatever proportions the two gases are mixed together, one volume of oxygen is invariably found to unite with two of hydrogen; and hence it is naturally inferred that the elements which enter into the composition of water, always combine in the same proportions.

Exper. 3.—Fill a jar two-thirds with oxygen gas, and introduce a piece of charcoal into the jar, over mercury, which is to be brought to the same level, both on the inside and on the outside. The charcoal being set on fire by means of a burning glass, the gas is at first expanded, but when it recovers its former temperature its bulk is nearly the same; and the whole of the oxygen, provided the quantity of charcoal be sufficient, is converted into carbonic acid. But in whatever way they are formed, the densities of oxygen gas and carbonic acid gas are to each other as 34 to 47 nearly; and from this it follows that carbonic acid must always contain the same weight of the base carbone and oxygen. The proportions by weight are 5.7 of the charcoal, and 15 of oxygen.

Exper. 4.—If two parts in volume of the gas called carbonic oxide, with one part in bulk of oxygen, are inflamed over mercury by the electric spark, two volumes of carbonic acid gas are obtained; the weight of which corresponds precisely to the weight of the carbonic oxide and oxygen gas employed. From this experiment it is obvious that the carbonic oxide contains only half as much oxygen as carbonic acid; so that the proportions of carbone and oxygen in carbonic oxide, are 5.7 of the former, and 7.5 of the latter. The decomposition of carbonic acid by electricity leads to the same result; for if two volumes of carbonic acid be treated in this way over mercury, two volumes of carbonic oxide and one volume of oxygen remain; and thus the composition of this gas is established, both synthetically and analytically.

In cases where a liquid and a solid enter into combination, the same determinate proportions are observed to take place. In the compound which is obtained by combining sulphuric acid with the earth of barytes, the solid precipitate of sulphate of barytes is uniformly found to consist of about 34 parts of acid and 66 parts of barytes, in the 100 parts of the compound.

When a mutual decomposition between two neutral salts is effected by an interchange of their elements, no excess of acid or of base appears. The new compounds are always perfectly neutral. Nitrate of barytes consists of 41 parts of acid, and 59 parts of the earth in 100 parts of the compound, and 67 parts of sulphate of potash, are composed of 30 of acid, and 37 of alkali. If a solution of the neutral salts in the proportions now mentioned, that is, 100 parts of nitrate of barytes and 67 parts of sulphate of potash, be mixed together, 89 parts of sulphate of barytes and 78 parts of nitrate of potash are obtained by the decomposition; and hence it appears that 30 parts of sulphuric acid combine with 59 of barytes and 41 parts of nitric acid, unite with 37 parts of potash.

The compounds of elastic fluids with solid substances, exhibit the same determinate proportions. The proportion of carbonic acid obtained from the sub-carbonate of potash, is exactly half the quantity obtained from the carbonate of the same alkali. In the black and the red oxides of iron, two proportions of oxygen combine with the former, and three proportions with the latter; that is, 100 parts of iron require 29 parts oxygen to be converted into the black oxide, and about 43.5 to become the red oxide.

But the reader who wishes to pursue this curious investigation may consult Dalton's *New System of Chemical Philosophy*, or Davy's *Elements*.

Chap. II. Of Light and Heat.

Light and heat act a very important part in the changes which are constantly going on among natural bodies. No change indeed takes place in which the one or the other is not either absorbed or evolved. In many of their properties, light and heat are analogous, but in some they are different. Both enter into combination with bodies; but light penetrates certain kinds of matter where the heat is in some degree interrupted; and heat is equally diffused through other bodies in which the progress of light is completely obstructed.

Sect. I. *Of Light.*

The sensation of vision is produced by the rays of light which proceed from the sun, or from burning bodies. Of the nature of light two opinions have been held. According to one of these opinions, all space is filled with a very subtile fluid; and this fluid being agitated or put in motion by the sun or burning bodies, is thrown into undulations or vibrations, which extend themselves to the eye, and render the bodies which have produced these motions visible. But according to the theory of Newton, light is supposed to be a subtile fluid, composed of peculiar particles of matter, which are constantly separating from luminous bodies, and entering the eye, excite the sensation of vision, or the perception of the objects from which it proceeds, or those from which it is reflected.

Physical properties.—The velocity of light is one of its most wonderful properties. It has been proved by astronomical observations, that it moves at the rate of 200,000 miles in a second; a velocity of which the human mind can form no distinct conception. Light passes from the sun to the earth in eight minutes, a space which a cannon ball, with its ordinary velocity, could not traverse in a shorter period than thirty-two years. The extreme minuteness of the particles of light may be inferred from its astonishing velocity; for as the impulse of moving bodies is in proportion to their quantity of matter multiplied by their velocities, if the one or the other or both be increased, the striking force is proportionably augmented; and hence if the particles of light were not exceedingly small, their excessive velocity would be highly destructive. Another proof of the great velocity of the particles of light is derived from the extreme facility with which they pass through transparent solid bodies, where they suffer no diminution of their velocity.

Reflection.—If a ray of light fall perpendicularly on a polished substance, it is thrown back in the same direction; but if the ray fall obliquely, it returns from the surface on the opposite side of a perpendicular line drawn from the point on which the ray falls, and at an equal distance from that perpendicular. The angle which the ray of light forms with the perpendicular as it falls is called the *angle of incidence*, and the angle which the ray of light forms with the same line when it is thrown back is called the *angle of reflection*. These two angles are exactly equal; and hence the optical law that the angle of incidence is equal to the angle of reflection.

Refraction.—If a ray of light pass in a direct line from one medium to another, as from air to water, or from water into air, it moves on in the same direction; but if it pass obliquely from one medium to another, it is bent from its former course, and then moves on in a new direction. This is called the *refraction of light*. A straight rod introduced obliquely into a vessel of water, appears bent at the place where it touches the surface, which is owing to the refraction of the rays of light passing from the rarer medium of the air to the denser medium of the water. When light passes from a rarer to a denser medium, as from air into water, it is refracted or bent towards the perpendicular; but when it passes from a denser into a rarer medium, it is refracted from the perpendicular. The quantity of this refraction is estimated by the density of the medium; but with this remarkable exception, that the refractive power of combustible bodies is in greater proportion than their density. Observing this fact in water and the diamond, Sir Isaac Newton threw out a conjecture that they are combustible bodies, a conjecture which has been fully verified by succeeding discoveries.

Prismatic spectrum.—When a ray of light is admitted through a small hole in the window shutter, and is received on a white surface, it forms a luminous spot; but if a triangular glass prism be interposed, the ray of light is not only refracted, but has assumed an oblong shape, and is divided into seven different colours. This image is called the *Prismatic Spectrum.* The colour and order of the seven rays are the following; and the spectrum being divided into 360 parts, the number of parts occupied by each of the colours are, red 45 parts, orange 27, yellow 48, green 60, blue 60, indigo 40, violet 80. As these different rays appear in different parts of the spectrum, their refractive power is different. Those rays which are nearest the middle are the least refracted, and those which are next the extremities suffer the greatest refraction. No farther change is produced on any of the rays by new refractions or reflections.

Transparency and opacity.—In its passage through some bodies, light seems to suffer no interruption. Such, for example, is glass or water; but it is interrupted in its passage through other bodies, as a piece of wood or stone. Bodies of the first description are said to be transparent, and those of the second kind are said to be opaque. This diversity of properties is not dependent on the density of the bodies, for water or glass is denser than wood. According to the explanation of Newton, the particles which compose transparent bodies are of equal density, and are uniformly arranged, and the light passing through them is equally attracted; but the particles of opaque bodies are of unequal density, and are unequally arranged, and the particles of light being unequally attracted, are constantly changing their course till they are finally interrupted.

The illuminating power of the different rays is very different; the brightest yellow, or the palest green, possesses the greatest power of illumination, which diminishes towards the extremities of the spectrum; and the violet ray is the most deficient.

Chemical properties.— Light, as well as other bodies, is subject to the universal law of attraction; it enters into chemical combination with many substances; and when such substances are placed in certain circumstances, the light which had combined with them is given out. This kind of light, which has been called *phosphorescent*, to distinguish it from that which is accompanied with perceptible heat, is given out by mineral substances, and during the decomposition of animal and vegetable matters.

Exper. 1.—Calcine in the open fire a few oyster shells, reduce them to powder, which is to be sifted through a fine sieve; mix three parts of this powder with one part of the flowers of sulphur; introduce the mixture into a crucible, and having pressed it firmly to the bottom, expose it to a red heat for an hour. When it is cool, scrape off the purest parts of the mass, and put it up in a well closed phial. The substance thus prepared, is *Canton's pyrophorus,* from the name of the discoverer. When it is exposed to the rays of the sun, or even to the light of day for a short time, the light which it gives out when carried into a dark place, renders objects distinctly visible. But being kept in the dark, it loses this property, which is only recovered by exposing it again to the light. When the light becomes feeble, or is nearly extinct, it may be revived or augmented by immersing the phial in hot water. This experiment shews that light is alternately absorbed and given out without inducing any perceptible change on the substance with which it combines.

Exper. 2.—Calcine a few clean oyster shells in the open fire or in a crucible, and preserving them entire, expose them to the sun's rays. When they are carried to a dark place, a beautiful light which is sometimes iridescent, is emitted. When the light is extinguished, it is again renewed by exposure to the sun's rays, and the iridescence is increased by calcining the shells in contact with iron or charcoal.

Exper. 3.—In a dark room, place a thin rhomboidal crystal of lime spar on a plate of iron which has just ceased to be red; in a short time a fine glow of white light appears, as if the whole mass were illuminated.

Exper. 4.—In the same circumstances put a quantity of blue Derbyshire spar on the plate of iron at nearly the same temperature, a great deal of a reddish purple light is extricated.

Exper. 5.—Divide a fresh herring longitudinally with a knife, and take about 4 drams weight, cut across, put it into a solution composed of two drams of Epsom salt dissolved in two ounces of cold water. On the second evening, a lucid ring is seen at the top of the liquid, and when the phial is shaken, it exhibits a fine luminous appearance, which continues for a day or two. Similar experiments may be made with common salt, sea-water, and Glauber salt, as well as with other fishes. *Phil. Trans.* 1800.

In the first and second experiments the light seems to have been absorbed and given out; in the experiments with the carbonate of lime and the Derbyshire spar, it seems to have entered as one of the constituents into the composition of these minerals, from which it is expelled by the application of heat, but is not recovered by a fresh exposure to the rays of the sun; and it appears to be one of the elements of organized matter which is separated at the commencement of decomposition.

The green colour of vegetables depends on the absorption of light; for when they are placed in other respects in the most favourable circumstances they become perfectly white; and on this principle the blanching of celery and other garden plants is practised, by which also their other qualities are greatly changed.

Sources of light.—The great source of light, as well as of heat, is the sun; and it appears from the experiments of modern philosophers, that the sun's rays are of three kinds: 1*st*, Rays which produce colour; 2*d*, Rays which produce heat; and, 3*d*, Rays which produce no perceptible light or heat, but some remarkable chemical effects. The rays which produce colour are within the limits of the visible spectrum; the rays which have the most powerful effect on the thermometer are beyond the limits of the red ray; and the rays which produce the greatest chemical effects are beyond the limit of the violet ray in the opposite extremity of the spectrum. These latter rays have the greatest power in reducing metallic salts or oxides.

Combustion is another copious source of light. Burning bodies in all cases give out light, so that it must have been one of the constituent parts of the substances which are employed in the process. Some bodies emit light when they are raised to a certain temperature without undergoing the process of combustion. Iron heated to 635° becomes visible in the dark; shines brightly at 752°, is luminous in the twilight at 884°, and shines in broad day only when the temperature exceeds 1000°.

Light is also given out by attrition or percussion, as when rock-crystal or quartz, or flint and steel, are struck against each other; and by rubbing two pieces of loaf-sugar smartly against each other a train of white light is thrown off.

Sect. II. *Of Caloric.*

In common language two different meanings are assigned to the word heat; to *feel* heat is meant the sensation excited in the body; but when the fire or a piece of metal is said to be hot, it denotes the power of exciting the sensation of heat existing in the piece of metal or the fire,—the one is the cause and the other is the effect. But to prevent ambiguity, the term *caloric* has been introduced into modern chemistry to signify the cause of the sensation.

Two opinions are held concerning the nature of caloric; according to one opinion it depends on a peculiar tremor or vibration, which is induced among the particles of heated bodies; but, according to another opinion, it is supposed to be a peculiar subtile fluid of a very elastic and penetrating nature, and universally diffused. The opinion of caloric being a distinct material substance, is most generally adopted, and seems to be most suitable for explaining the phenomena which accompany all the changes and effects which it produces.

The particles of caloric are attracted by other kinds of matter, and enter into combination with it; their velocity is the same as that of light, and their minuteness is not less. Like the rays of light, caloric is reflected from polished surfaces, and refracted when it is transmitted through transparent bodies.

Exper. 1.—Place two concave mirrors of tinned iron, of nine inches focus, at about twelve feet distance from each other; let a ball of iron of two inches diameter, heated to that degree so as not to be visible in the dark be fixed in the focus of the one, and the ball of a thermometer in the focus of the other. In a few minutes the thermometer will indicate a rise of temperature corresponding to the heat of the iron ball, and in consequence of the rays being reflected from the polished surface.

Exper. 2.—Substitute a lighted candle for the ball of iron, and a similar effect, though not in the same degree, will be produced.

Exper. 3.—Interpose a plate of glass between the two mirrors, while the heated iron ball is in the focus of one, and has previously raised the temperature of the thermometer, the interposition of the glass will immediately occasion a fall in the thermometer; thus proving that the rays of caloric are interrupted, while the rays of light are not perceptibly diminished. When the plate of glass is removed, the thermometer again indicates an increase of temperature.

Exper. 4.—Place the mirrors at the distance of ninety inches from each other, and let a glass vessel with boiling water be substituted for the iron ball in one focus, and a delicate thermometer in the other; suspend in the middle space between the mirrors, a common glass mirror, so that either side may be turned towards the glass vessel with the boiling water. When the polished side of the glass mirror is turned towards the glass vessel, the rise of the thermometer is very small; but when the other side, which should be darkened, is turned towards the glass vessel, the thermometer will rise three or four degrees. In one experiment conducted in this way, the thermometer rose three degrees, when the polished side of the mirror was presented to the boiling water, and nine degrees when the other side was turned to it.

These experiments prove clearly the reflection of the rays of caloric; they prove also that the rays of light and heat may be separated, and are not transmitted through all bodies with the same facility; and the intervention of the mirror in the last experiment shews a remarkable diversity of effect in the transmission of the rays of caloric by different surfaces of the same body.

1. *Equal distribution of Caloric.*

If a number of bodies of unequal temperatures be brought into contact with each other, or placed in the same medium, in a certain time they are all reduced to the same temperature, and indicate the same degree of heat. Thus, if one body be at the temperature of 50°, if another be raised to that of 100°, and a third to that of 200°; and if the three bodies be placed in the temperature of 80°, they will all in a short time acquire the same temperature. The body at the temperature of 50° will be raised to 80°, and the two bodies at the higher temperature will be reduced to the same degree. This is called the *equilibrium*, or equal distribution of caloric; and to whatever degree bodies are heated or cooled, they all acquire in time the temperature of the surrounding medium, when they are permitted to communicate freely with each other.

As bodies are deprived of caloric by radiation from their surfaces, as well as by direct communication with these bodies with which they are in contact, the difference of time in which bodies of a different nature acquire the same temperature is very considerable,—since it must depend on the nature of the surface which gives out or receives caloric, and on the conducting power which is also very different in different kinds of matter. Bodies which are good conductors of caloric, cool most rapidly.

Exper. 1.—Take a pound of mercury and a pound of water in different vessels, and having raised them to the temperature of 100°, let them be placed in a medium, the temperature of which is 50°, the mercury will be found to have acquired the temperature of the surrounding medium in a much shorter time than the water, because it is a much better conductor of heat.

2. *Motion of Caloric.*

When caloric passes from one body to another, it is either transmitted from the heating body through the intervention of another in contact with the body which receives the caloric, and in this case it is said to be *conducted*, and then it passes slowly; or it is directly transmitted without the intervention of other bodies, as when the heat proceeds from the sun or from the fire, and then it is said to be *radiated*, in which case the passage of the rays of caloric is comparatively instantaneous.

Conducting power of bodies.—The conducting power of different bodies is very different; metallic substances are the best conductors; porous substances, as cork, wool, feathers, or furs, allow caloric to pass through them very slowly, and are therefore bad conductors; and hence woollen stuffs and furs answer best for clothing in cold countries, because the heat of the body is very slowly dissipated by their inferior conducting power. The remarkable diversity in the conducting power of bodies may be shewn by a simple experiment.

Exper. 1.—Take a rod of iron and a rod of wood of the same thickness and about a foot in length; introduce one extremity of both rods into the fire, while the other extremities are held by the hand. When the extremity of the rod of iron which is in the fire has become red hot, the heat of the other extremity will be too great for the hand; but the rod of wood may be held in the hand till it is nearly consumed, without the least uneasy sensation. This difference arises from the difference of the conducting power in the metal and the wood.

Exper. 2.—Prepare a number of short wires of silver, copper, lead, iron, and tin, with some of glass and wood nearly of the same size and length, and coat one of the ends of each by dipping it into melted wax or tallow, and immerse the other extremity into boiling water or hot sand,—in a short time the wax or tallow will melt, first from the metallic rods in the order of their conducting power, next from the glass, and last of all from the wood.

The conducting power of metals is not in proportion to their density, as might be at first sight expected. Silver and gold possess it in the highest degree, and copper and tin are much better conductors than iron, steel, lead, or even platina, which is the densest of all metals. Liquid substances are also conductors of caloric; but it passes through them very slowly. Elastic fluids or gases possess this conducting power in a still lower degree than liquids; and hence the advantage of having double windows, a practice which is common in the construction of houses in northern climates. The stratum of air between the two windows being a bad conductor of caloric, the dissipation of the heat of the apartment is thus prevented. Of the elastic fluids, hydrogen gas has been found by experiment to conduct caloric four times better than atmospheric air.

Radiation.—Bodies raised to a higher temperature than the surrounding medium, continue to give out heat till they acquire the same temperature. This radiating power is very different in different states of the same body; and from the curious experiments of Mr Leslie, it appears that the rate of cooling is greatly influenced by the nature of the radiating surface. Polished surfaces give out heat most slowly.

Exper. 1.—Fill a globe of tinned iron with hot water, and observe the time that it requires to cool a certain number of degrees. Cover it afterwards with a thin coat of lamp black, and it will be found to be reduced to the same temperature in nearly half the time.

Exper. 2.—Prepare a canister of tinned iron of six or eight inches square, and let it be furnished with an orifice at the middle of the upper side, of about an inch in diameter, and make a small hole to receive the stem of a thermometer in the covering of the orifice. Let one of the sides of the canister remain bright, tarnish another with quicksilver, destroy the polish of the third side by scratching with sand paper, and cover the fourth side with black paint. Place the canister filled with boiling water before a concave mirror of polished tin, and fill it with boiling water. The differential thermometer is to be placed in the focus of the mirror. The nearer the canister is placed to the mirror, the greater is the effect on the thermometer; but the different sides of the canister presented to the mirror produce very different effects. The bright polished side gives out the smallest quantity of heat, and the side covered with black paint the greatest quantity. As a proof of this difference, it has been found from experiment, that while the radiating power of lamp black is equal to 100°, that of tin plate, polished gold, silver, or copper, is only equal to 12°.

These experiments furnish some excellent practical observations. When it is wished to preserve the heat of any substance confined in a metallic vessel, the surface should be kept polished and bright; and hence a silver or polished metal tea-pot retains the heat much longer than one of porcelain or earthen ware. If it be required to cool any substance quickly, the surface of the containing vessel should be painted or tarnished. Metal pipes which are employed to convey steam, should be kept polished and bright to diminish the radiating power.

3. *Effects of Caloric.*

When heat enters into combination with bodies, its effects are very different according to the nature of those bodies, or as it is more or less accumulated in them. Expansion, or the enlargement of bulk, is the most general effect; and when the accumulation is continued in some bodies, their constitution is changed, as when a solid body is converted into a liquid, and with a larger proportion of caloric a liquid is changed to the state of vapour. The composition of certain bodies is also changed by means of caloric.

Expansion.—The enlargement of the bulk of bodies when heat is accumulated in them, and their corresponding contraction when heat is abstracted, is one of its most general effects; and in all the simpler kinds of matter, these effects are uniform and invariable. This expansion, by the accumulation of caloric, takes place in the solid, the liquid, and the gaseous state of bodies.

Exper. 1.—Take a rod of iron of an inch in diameter and six or eight inches in length, and let it be exactly fitted to pass through a hole in a plate of the same metal, and to be admitted within the projecting edges of a ruler when it is cold. Expose the same rod of iron to a red heat, when it will be found to have enlarged so much in bulk, both in length and diameter, that it can neither be passed through the hole nor introduced between the projecting edges of the ruler; but when it is cooled down to its former temperature, it returns to its former dimensions.

Exper. 2.—Fill the body of a glass vessel, having a long slender neck, with spirit of wine or alcohol; immerse the body of the vessel in hot water, and the liquid will be observed to rise in the neck; and when the temperature is reduced to its former temperature, it returns to its former bulk.

Exper. 3.—If a quantity of common air be introduced into a bladder, so that it shall remain partly flaccid; by the application of heat it will be fully distended; but when it is again cooled, the air resumes its former bulk.

The amount of expansion is very different in different bodies; it is least in solids, greater in liquids, and greatest of all in elastic fluids: thus 100 cubic inches of iron, when raised from the temperature of 32° to 212°, are increased only one-tenth in bulk; 100 cubic inches of water raised to the same temperature are increased $4\frac{1}{2}$ cubic inches; and 100 cubic inches of atmospheric air raised to the same temperature are increased to $137\frac{1}{2}$ cubic inches.

The method of applying iron hoops to carriage-wheels, affords a fine illustration of the expansion of solid bodies by heat, and their contraction by cold, or the abstraction of heat. The hoop is made of rather smaller dimensions than exactly to fit the wheel. It is then made red hot, and in this expanded state it is applied to the wheel, and suddenly cooled with cold water, when it contracts and returns to its former dimensions. The expansive effect of heat furnishes an explanation of the breaking of vessels which are made of brittle substances, as glass, earthen-ware, or cast-iron, by its sudden application, or abstraction. When heat is applied suddenly, that part of the vessel which first receives the accumulation of caloric is unequally expanded, and when the vessel is of considerable thickness it never fails to be broken.

Different kinds of bodies, whether they are solids, liquids or aeriform substances, undergo different degrees of contraction and expansion, by the accumulation and abstraction of caloric. Advantage has been taken of this diversity of expansion in different metals at the same temperature, in the construction of the pendulum, on the length of which continuing always the same, depends the equable measurement of time. This is done by employing rods of different metals, the amount of the expansion of which is the same, and the rods being so arranged that they expand in opposite directions, the pendulum thus remains uniformly of the same length.

Water and some metallic substances, particularly cast-iron, when they pass from the liquid to the solid state by the abstraction of caloric, are enlarged in bulk, and thus present seeming exceptions to the general law of expansion. Water, when it is confined in close vessels and frozen, bursts them with great violence, and, it has been estimated, acts with a force equal to a pressure of more than 27,000 pounds weight. The bursting of water-pipes, the splitting of trees and rocks, and the raising of the stones of the pavement in the time of frost, is ascribed to the same expansive force in the congelation of water. To the same increase of bulk in cast-iron, when it cools, are owing the sharpness and distinctness of the lines in ornamental figures of this metal; but this increase of bulk has been properly accounted for by a new arrangement of the particles of these bodies when they assume the solid form, or to crystallization, by which a greater space is occupied than when they are in the form of liquids.

The expansion of solids is nearly equable, that is, the amount of expansion is nearly the same at the same degrees of temperature. The expansion of liquids is not equable with equal degrees of temperature. Those liquids which are most readily brought to the state of vapour expand most, and the expansion is greater the nearer a liquid is brought to that point of temperature at which it boils. At any given temperature, alcohol, whose boiling point is lower, expands more than water, and the expansion of water is greater than that of mercury. With the same addition of heat, elastic fluids undergo very nearly the same ratio of expansion.

Construction of the Thermometer.—The thermometer, an instrument of great importance in measuring the relative temperature of bodies, depends for its construction on this expansive property. The invention of this instrument is ascribed to Sanctorio, an Italian physician, who lived about the commencement of the 17th century; but it is said that it was known in Holland before his time. The thermometer of Sanctorio was a glass tube, having a hollow ball at one end, and open at the other. The air within the ball being heated, part of it is driven off, and the open end of the tube being immersed in a coloured liquid, as the air within the ball cools, the liquid rises in the tube, and is elevated or depressed as the air in the ball is expanded or condensed by the accumulation or abstraction of caloric, and thus indicates the changes of temperature to which the air within the ball is exposed. A scale of equal degrees is applied to the whole length of the tube, by which the changes may be observed. Other liquids were afterwards employed, as spirit of wine, linseed oil, and quicksilver; and the ball and part of the tube being filled with one of these liquids, the open end of the tube is closed, and thus the influence of the pressure of the atmosphere is precluded.

In the construction of Fahrenheit's thermometer, which is in most general use in this country, a small tube, of uniform width throughout, is selected, and a small ball is blown on one of the extremities. The ball and part of the tube are then filled with quicksilver, which is previously boiled to expel the air, and the open end of the tube is hermetically sealed, or closed, while the glass is softened in the flame of a lamp. The scale is next constructed. Melting

Caloric.

snow, or freezing water, is always at the same temperature. If, then, the thermometer be immersed in the one or the other it will always stand at the same point. This point is marked 32 on the scale, and is called the freezing point. The thermometer is then introduced into boiling water, and the point at which the quicksilver stands is marked 212. The intermediate space between the freezing and boiling points is divided into 180 degrees, and the same divisions are continued above the boiling point and below the freezing point, as far as the range of the thermometer extends.

Reaumur's thermometer, which was at one time generally used in France, is marked *zero* at the freezing point, and 80 degrees at the boiling point. To convert the degrees of Reaumur's thermometer to those of Fahrenheit, multiply by 9, divide by 4, and add 32.

The thermometer of Celsius, which is used in Sweden, and the centigrade of France, has the space between the freezing and boiling points divided into 100 degrees. To convert the degrees of this thermometer into those of Fahrenheit multiply by 9, divide by 5, and add 32.

The thermometer used in Russia, which is that of Delisle, is divided into 150 degrees between the boiling and freezing points. The boiling point is marked *zero*, and the degrees are reckoned downwards to the freezing point. To reduce the degrees of this thermometer under the boiling point to those of Fahrenheit, multiply by 6, divide by 5, and subtract 212; and above the boiling point, after the same multiplication and division, add 212.

Quicksilver has been selected for the purpose of thermometers, because it expands more equably than any other liquid. But even the expansion of this liquid is not perfectly equable throughout all parts of the scale. In the higher parts the expansion is greater with equal degrees of temperature.

Water exhibits a singular anomaly in its expansive property. Its greatest density is about 40° or 42°, and it continues to expand equally, whether the temperature be raised above that point or reduced under it. This curious fact, which has been a good deal investigated, yet requires explanation.

Fluidity.—All matter exists in three different states, namely, in the state of solid, liquid, and vapour, and with few exceptions it may be converted from the one to the other by the accumulation or abstraction of caloric. A mass of ice, with the addition of heat, becomes liquid, or is brought to the state of water, and if the accession of heat be continued, the whole is changed into the form of vapour; and, on the other hand, by the abstraction of caloric from a quantity of aqueous vapour, it returns to the state of water; and, being still farther reduced in temperature, becomes solid, or is converted to the state of ice. Thus, with few exceptions, it is a general law, that matter is convertible from one state to the other. Among these exceptions the air of the atmosphere may be mentioned, which always exists in the aeriform state; and spirit of wine is only known in the form of vapour and liquid, but never solid.

It is another general law in the conversion of solid substances to the state of fluids, that the change takes place, when the circumstances are the same, invariably at the same temperature. Ice becomes liquid at the temperature of 32°, and is converted into vapour at 212°.

Some bodies are instantaneously converted to the state of liquid, as water from the solid form, while others, as wax, pass through the various degrees of softness till they become quite fluid. The cause of fluidity, which was so finely elucidated by Dr Black, may be reckoned among the most beautiful and important discoveries of modern chemistry. The foundation of his doctrine is fully established by the following experiment:

Exper.—Two thin glass vessels, each containing five ounces of water, were placed in a large hall, the temperature of which was 47°. The water in one of the vessels was frozen, and in the other it was reduced to the temperature of 33°. A thermometer was placed in each vessel, and the thermometer in the water rose in half an hour from 33° to 40°, or seven degrees in the half hour. But the ice glass did not rise above the temperature of 32° till the whole of the ice was melted, which was at the end of 21 half hours, and in a few minutes afterwards the thermometer in it also rose to 40°, or eight degrees above the freezing point, and the same as in the other glass. During the whole 21 half hours the heat was absorbed by the ice, and if this absorption continued at the same rate of seven degrees every half hour, the whole amounted to seven times 21, or 147°. But this 140° was not indicated by the thermometer. It remained concealed in the water, or, being absorbed by the ice, reduced it to the liquid state. In short, this combination of caloric with the ice is the cause of its assuming the liquid form, and because it is not indicated by the thermometer Dr Black gave it the name of *latent heat*. By others it has been called *caloric of fluidity*.

The converse of this experiment proves the same thing; for as caloric is absorbed when bodies pass from the solid to the liquid state, so, on the other hand, it is given out when a liquid is converted into a solid. When water is cooled down ten or twelve degrees below the freezing point without being frozen, which may be done with a little management, by keeping the water undisturbed in a close vessel; the moment it is exposed to the air or agitated, it is changed into a porous mass of ice, and at the same time that portion of caloric which is necessary to retain it in the liquid form is given out. But this change is finely illustrated by the following simple experiment:

Exper.—Fill a phial with a saturated solution of Glauber salt, that is, add as much of the salt as boiling water will dissolve, and while it is boiling hot put in the cork tight, to exclude the air. In this state, if left undisturbed, it may be kept liquid; but after it has cooled down to the ordinary temperature of the atmosphere, if the cork be taken out, the whole becomes almost instantaneously solid, with the extrication of so much caloric as to feel sensibly warm to the hand.

The temperature at which water becomes solid is

32°, and this is called the freezing point, because water is most commonly in the liquid form in this climate. When applied to metals, because they are usually in the solid form, it is called the melting point. It is very different in different bodies, but uniformly the same in the same body. The melting point of lead is 600°, of tin 500°, of sulphur 212°, of wax 142°, of phosphorus 100°, and tallow 90°.

Vapour.—If, after the whole of a mass of ice is converted into the liquid form, or into the state of water, the application of heat be continued, the temperature rises and continues to increase till it reaches a certain point, at which the water undergoes another change. It is converted to the state of vapour, or steam, and this change is owing to the same cause which produced the conversion of the ice into water, namely, the absorption of caloric. This fact was also established by Dr Black; and, according to his experiments, a quantity of caloric absorbed for the conversion of water into steam, would have raised that water to the temperature of 800°, which, in his mode of expression, is the *latent heat* of vapour, because it is not indicated by the thermometer. This quantity is estimated higher by others, and by Lavoisier as high as 1000°.

The point at which liquids are converted into vapour is uniformly the same under the same pressure of the atmosphere. In water this point is at 212°, and it is called the boiling point. The process of boiling is nothing else than the conversion of the liquid into the state of an invisible elastic fluid or vapour. As the heat is generally applied to the bottom of the vessel, that part of the liquid which is in immediate contact with it is first changed into the form of vapour, and in its passage through the water causes the agitation or ebullition.

Some liquids assume the form of vapour at all temperatures; this is the case with water, spirits of wine, and other liquids, which are soon dissipated if they are exposed to the air in open vessels. But other liquids lose no sensible part of their bulk, till their temperature reaches the boiling point. The boiling point of ether, an extremely volatile liquid, is only 98°, of ammonia 140°, of spirits of wine 174°, of water 212°, of linseed oil, 600°, and of mercury 660°. But the boiling point of the same liquid varies with the variations in the pressure of the atmosphere. Water, and other liquids boil at a diminished temperature on the top of high mountains, or in the vacuum of an air-pump.

Exper. 1.—Boil a quantity of water in a glass vessel, furnished with a well-fitted stop-cock, and when the boiling is going on let the vessel be shut, and the application of the heat continued a few minutes, the boiling will then apparently cease, or at least the agitation will be greatly diminished. At the end of a few minutes, when the stop-cock is turned, a great quantity of steam will rush from the vessel, accompanied with a violent ebullition of the water. The steam which thus escapes is the vapour which was formed while the vessel was shut, and its gradual escape was prevented, and at the same time the agitation of the water was diminished, in consequence of that part of the vessel which is unoccupied by the water being filled with vapour, the pressure of which on the surface of the water prevents the agitation. When the vapour is permitted to escape, the temperature never rises higher than 212°, but in close vessels, as in Papin's Digester, it may be raised to 300° or 400°, in consequence of the accumulated vapour.

Exper. 2.—While the water is boiling in the vessel employed in the former experiment, if the stop-cock be shut, and the heat be withdrawn, the ebullition will entirely cease in a few minutes; let the vessel then be immersed in cold water, and the boiling will be renewed. Immerse it afterwards in hot water, and the boiling will cease. This experiment, which is called the *chemical wonder*, affords a fine illustration of the conversion of a liquid into vapour by the addition of caloric, and of the change which it undergoes in returning to the state of liquid, by the abstraction of heat. When the vessel was removed from the heat, and the stop-cock was shut, the upper part of it was filled with vapour, which, in that state, is an invisible elastic fluid. But when the vessel is introduced into the cold water this vapour is deprived of its caloric, and returns to the liquid state; the pressure is then removed from the surface of the water, and the heat which remains occasions a renewal of the ebullition; but when the vessel is immersed in hot water, the vapour expands, and, pressing on the surface of the water, causes the boiling to cease. As a farther proof of the condensation of the vapour, if the mouth of the vessel be inverted in water, and the stop-cock turned, provided it be sufficiently tight, the water will rush up with great force, and fill the vessel.

Exper. 3.—Boil three or four ounces of water in a vessel, having a communication, by means of a bent tube, with a determinate quantity of cold water in another vessel. Let the boiling be continued till the cold water is raised to the boiling temperature, and then take a quantity of water, equal to what was driven off in the state of vapour, and mix it at the boiling temperature with as much cold water as that to which the steam was conveyed. In the latter case, a slight increase of temperature only will be observed, but in the former the cold water was raised to the boiling point, thus demonstrating the latent heat of the vapour.

The cooling of bodies, by means of evaporation, also furnishes a proof of caloric being copiously absorbed by vapour. If the bulb of a thermometer be moistened with spirits of wine, or still more effectually with ether, the rapid evaporation abstracting the caloric from the mercury causes it to sink in the tube. Even water may be frozen by this process; if ether be dropt slowly on a small glass tube containing a small portion of water, the latter may be frozen in a short time. On the same principle wine is cooled either by surrounding the bottle with a wet cloth, occasionally moistening it as it dries, or introducing it into a vessel of porous earthenware, from the surface of which a rapid evaporation takes place. On the same principle, too, ice is produced in the East Indies; the water is put into shallow unglazed pans, which suffer it to oose out at the pores, and the vessels being placed on the dried stems of plants, which being bad conductors of caloric, prevent its communication with the earth. A current of air greatly promotes the process, for the vapour as it is formed is driven off, and permits a fresh portion to occupy its place. In passing through a filtering-stone, water is cooled down, not only in consequence of the evaporation from the sides of the stone, but also by the drops of water being partially converted into vapour, as they pass through the air. Of the conversion of vapour into the liquid state, the water trickling down in numerous streams on the windows and walls of crowded apartments, arising from the great quantity which is given out in breathing, and coming in contact with the cold walls and windows, furnishes a very apposite and familiar example.

Bodies decomposed by caloric.—The combination of caloric with bodies not only produces expansion and fluidity, or changes in bulk and constitution, but when compound bodies are subjected to high degrees of temperature, they are reduced to their elements, or the elements treated in the same way are formed into compounds. Thus metallic substances, which have entered into combination with oxygen, or oxides, as they are called, when exposed to a red heat, are decomposed, and a portion of the oxygen combining with caloric, appears in the form of an elastic fluid, or oxygen gas, which is a compound of oxygen and heat. When the vapour of water is passed through a tube containing iron at a red heat, the oxygen of the water combines with the iron, and forms an oxide, while the hydrogen passes off. If the vapour of ammonia be passed through a red hot tube, it is resolved into its constituents, hydrogen and azote, which, having united with caloric, appear in the form of gas; and if hydrogen and azotic gasses be passed through a red-hot tube, they enter into combination, and are converted into ammoniacal gas.

Quantity of caloric in bodies.—The researches and speculations of chemical philosophers who have occupied their attention in ascertaining the quantity of caloric in bodies, are directed to two objects, one of which is to determine the absolute or entire quantity which exists in any body, and the other is to discover the relative proportion which different bodies require to raise them to the same temperature. The speculations on the first point have not been attended with much success, and do not seem to be practically useful. The specific caloric of bodies can be more satisfactorily explained.

It might appear at first sight that the same quantity or bulk of different kinds of matter might be brought to the same temperature by the accesion or abstraction of equal quantities of caloric. But the case is quite different; for different bodies require different quantities of caloric to raise them to the same temperature.

Exper. 1.—Take one pound of water, at the temperature of 100°, and mix it with another pound of water at the temperature of 50°, the acquired temperature of the mixed quantities of water will, in a short time, be the mean between 50 and 100°, for the pound of water at the higher temperature will give out 25°, and the pound of water at the lower temperature will receive 25°, and the mixture will be at the temperature of 75°.

Exper. 2.—Take a pound of water at 100°, and a pound of mercury at 50°, and mix them together, the medium temperature in this case is not obtained, but is reduced only to 88°, and therefore the water has lost only 12°, while the mercury has gained 38°.

Exper. 3.—Take one pound of water at 50°, and a pound of mercury at 100°, and when they are mixed together the temperature will be only 62°, for the mercury gives out 38°, and the water receives only 12°. This experiment shews clearly that different quantities of caloric are necessary to increase or diminish the temperature of different bodies, for the quantity which raises water 12°, raises mercury no less than 38°. This is called the *specific caloric* of bodies. This difference in bodies is also denoted by the term *capacity for heat*; and the body which requires the greater quantity of caloric to raise it to the same temperature, is said to have a greater capacity for heat.

A few examples of the specific caloric of bodies may be given. These are compared with the specific caloric of water, which is reckoned 1.000. The specific caloric of hydrogen gas is 21.4000; of oxygen gas, 4.7460; of common air 1.7900; of common salt, dissolved in 8 parts of water, 0.832; of muriatic acid, 0.6800; of oak, 0.51; of quicklime, 0.2199; of iron, 0.1264; and of lead, 0.0424.

Cold.—The term *cold*, strictly speaking, is the abstraction of a quantity of heat, or is expressive of the relative temperature of two bodies. If the hand be held in water at the temperature of 100°, for a few minutes, and then suddenly immersed into another portion of the same liquid at the temperature of 40°, the latter is said to be *cold*, a term which is obviously expressive of the sensation excited in the body. This is easily illustrated by experiment.

Exper.—Take three quantities of water, the first at the temperature of 33°, or 34°, the second at the temperature of 50°, and the third at the temperature of 100°. Put the right hand in the water at the highest temperature, and the left into the water at the lowest, and having kept them for a minute, suddenly immerse both hands in the water at the temperature of 50°, the water will feel cold to the right hand, and warm to the left hand; and thus the same body produces different sensations, while it is at the same temperature, arising from the previous state of the hands, and the absorption of caloric by the one, and its abstraction by the other.

Before the modern doctrines of the absorption and abstraction of caloric were fully established, cold was considered as a distinct body, and not as a term expressive of the absence of some other body, and frigorific particles were as familiarly spoken of as the particles of any other matter. This opinion received some support from the experiments of M. Pictet of Geneva, in which cold seemed to be reflected.

Exper.—Two concave mirrors of tinned iron were placed at the distance of $10\frac{1}{2}$ feet from each other; a thermometer was placed in the focus of the one, and a glass vessel full of snow was placed in the focus of the other; the thermometer sunk several degrees; when the snow was removed it rose again, and when a greater degree of cold was produced on the snow by pouring an acid upon it, which dissolved it rapidly, the thermometer fell several degrees lower. From these appearances it has been supposed that the cold given out by the snow is reflected by the mirrors, and causes the fall of the thermometer; but in this case the thermometer having a higher temperature than the snow, may be considered as the heating body; and on the principle of the equal distribution of caloric going on among bodies at different temperatures, till they reach the same degree, the interchange of the heat in the thermometer, and the snow, is greatly facilitated by the favourable circumstances in which they are placed.

Freezing mixtures.—Great degrees of cold are artificially produced by mixing together those substances which dissolve rapidly. The conversion of a solid to the liquid state, it will be recollected, is owing to the absorption of caloric, and when this process proceeds rapidly, a great diminution of temperature may be produced. In the production of artificial cold, mixtures of the neutral salts dissolved in water are generally made, or of diluted acids with some of the neutral salts, or of snow or pounded ice, with some of the same salts. A mixture of five parts of sal ammoniac, five parts of nitre, and sixteen parts of water at 50°, reduce the temperature to 10°. The same proportions of sal ammoniac, nitre, and water, with the addition of eight parts of Glauber salt, produce a degree of cold equal to 4°. Glauber salt eight parts, and muriatic acid five parts, reduce the temperature from 50° to 0°. Equal parts of snow and common salt, reduce the temperature from thirty-two to 0°. Three parts of muriate of lime, with two parts of snow, reduce the temperature from 32° to 50° below 0°; and two parts of muriate of lime, with one of snow, reduce the temperature from 0° to 66° below it. A full account of freezing mixtures may be seen in Mr Walker's Memoirs, in *Phil. Trans.* for 1795 and 1801.

When these substances are to be employed as freezing mixtures, the salt should be fresh crystallized and reduced to fine powder, and the different ingredients should be separately cooled down to that degree from which the lower temperature is reckoned. Thus, if it be the object to freeze mercury, and if muriate of lime and snow be employed for that purpose, a mixture of three parts of muriate of lime, and two parts of snow, being reduced by some other freezing mixture to the temperature of 32°, or some degrees below it, another portion of the same ingredients in separate vessels may be cooled down to *zero*. These materials being speedily mixed together, will produce a temperature equal to 50° below *zero*; and at the temperature of 40°, mercury becomes solid.—Vessels of tin-plate, or such as are the best conductors of caloric, are employed in these processes; and when acids are used, they may be lined with a coating of wax; the vessel should be of no larger dimensions than what is sufficient to contain the materials.

4. *Sources of Caloric.*

Five different sources of caloric have been enumerated according to the nature of the powers from which it is derived, or the means by which it is evolved, namely, the sun, combustion, percussion, friction, and mixture.

1. *The Sun.*—The great source of light and heat in our planetary system, is the sun. The speculations of philosophers have been occupied in considering the constant waste of light and heat to which the sun must be subjected. It has been calculated that at the rate of two grains a day the diameter of the sun would be shortened ten feet in 6,000 years. But, according to the observations of Dr Herschel on the nature and constitution of the sun, it appears that the body of the sun is opaque, that he is surrounded with an atmosphere like that of the earth, and that this latter is surrounded by a luminous atmosphere, from which are emitted all the light and heat, which were supposed to proceed from the body of the sun. In consequence of changes which seem to be constantly going on in this luminous atmosphere, it exhibits different degrees of splendour; and during these variations, the difference in the quantity of light and heat given off is very great; and to these changes Dr Herschel ascribes the average difference of temperature in different seasons, and the consequent abundance or deficiency of the crops.

The rays of light, as well as those of caloric, are more copiously reflected from white surfaces, than from those of a deeper colour. The rays enter the opaque body, combine with it, and increase the temperature, but they pass through transparent bodies. The absorption of caloric by opaque substances is illustrated by the following experiments.

Exper. 1.—Take four pieces of cloth of the same size, but of different colours, as black, blue, red, and white; expose them on a surface of snow to the sun's rays, and after they have remained for some time in this situation, it will be found that the black has sunk deepest, the blue nearly to the same depth, the red to a less depth, and the white scarcely at all. In this experiment, which was first made by Dr Hooke, and afterwards by Dr Franklin, the pieces of cloth sink into the snow in consequence of the caloric which they absorb from the sun's rays, and the effect is greatest in those which are of the darkest colour, while the whole of the caloric as well as light is reflected by the white cloth. The common experience of black clothes being warmer, and the practice of light coloured garments being worn by the inhabitants of warm climates, are illustrations of the same fact.

Exper. 2.—Sir H. Davy prepared six similar pieces of copper, each one inch square, and about two lines in thickness, and painted them of different colours, of white, yellow, red, green, blue, and black. A thin layer of cerate, composed of oil and wax, which melted at 76°, was attached to the under surface. They were placed on a board painted white, and the upper surfaces were exposed to the sun. The cerate on the black plate melted first, the blue next, the green and red followed, and the yellow last; but the white was scarcely affected when the black was in complete fusion.

Berard's experiments.—The experiments of Berard, an account of which was laid before the French Institute in 1813, lead to conclusions somewhat different from those of Dr Herschel, concerning the effects of solar light. He found the heating power increased from the violet end of the spectrum to the red ray, and it was greatest at the very extremity of the red ray; but beyond it the thermometer was only one-fifth above the temperature in the surrounding air of what it had been in the red ray itself; and the absolute intensity of the heat was less than in Dr Herschel's experiments.

The two spectra produced by transmitting a pencil of rays through a prism of Iceland spar, exhibited the same properties. In both, the heating power diminished from the violet to the red end, and ceased nearly beyond the last visible red rays. But the luminous particles being polarized by the crystal in this operation, Berard attempted to discover whether the invisible rays of heat experienced the same effect. To ascertain this point, he received the solar ray upon a polished transparent glass, which polarized or directed a portion of it by reflection. This reflected ray was received upon a second glass fixed in an apparatus, which permitted it to be moved in the ray under a constant incidence, the incidence itself being so determined that in a certain position of the glass the reflection ceased to take place. The heating and luminous rays being collected with a mirror, reflected from the second glass, and directed upon a thermometer, he found that as long as light was reflected, the thermometer rose, from which he concluded that heat must be reflected likewise; but when the light was totally transmitted, the transmission of the heat took place at the same time, for the thermometer was not affected.

In another experiment, in place of the ray of solar light, he substituted a ray of radiant heat, proceeding from a body hot but not luminous, and the same effect followed; for the thermometer rose when the second glass was so situated as that it would have reflected light, and it did not rise when the second could not have reflected light. From these experiments he concluded that the heating principle never separates from the luminous particles; and that the particles of invisible radiant heat are modified by reflection precisely like light.

To determine the chemical effects of the differently coloured rays, pieces of card impregnated with muriate of silver, or small phials filled with a mixture of oxymuriatic and hydrogen gases, were successively subjected to their action, from which the power of each might be seen by the intensity or rapidity of the chemical change; and it was found, that the chemical intensity was greatest at the violet end of the spectrum, and that it extended a little beyond that extremity, but continually decreased as it approached to the indigo and blue rays.

Having concentrated, by means of a lens, that part of the spectrum which extends from the green ray to the extreme violet, and by means of another lens all that portion which extends from the green ray to the extreme red; and although the last pencil formed a white point, so brilliant that the eye could scarcely bear it, yet the muriate of silver exposed for two hours to this brilliant light, exhibited no perceptible change; while, after being exposed to the other pencil, greatly inferior in brightness and in its effects on the thermometer, it was blackened in less than six minutes. From these experiments he concluded, that the chemical effects produced by light are not owing to the heat combining with the substance of the body, because, on such a supposition, the faculty of producing chemical combination would be greatest in those rays which have the greatest heating power.

The hypothesis which Messrs Berthollet, Chaptal, and Biot, who presented the report on the curious memoir of Berard to the Institute, seem disposed to adopt, is, that light is composed of a collection of rays unequally refrangible, and of course unequally acted upon by bodies. This view supposes original differences in their size and velocity, or in their affinities; and hence it would appear, that the chemical, colorific, and calorific, or heating effects of light, depend on the difference of force of the homogeneous power producing the sensations and effects of light. The power of producing vision is confined within certain mean limits; too little, or too much refrangibility, renders it incapable of producing that effect; and the heating and chemical faculty varies through the whole length of the spectrum, in the same degree with the refrangibility, but in contrary proportions.

2. *Combustion.*—The remarkable appearances which are exhibited in the process of combustion, the changes induced on the substances employed, and the important results which are obtained, could not escape notice, and could not fail to excite great interest and attention. As combustion is one of the principal sources of heat, it has long occupied the attention of chemical philosophers, both with regard to the means of improving the process in the arts of life, and to the discovery of a theory capable of affording a satisfactory explanation.

When a piece of iron is exposed to a high temperature it becomes red hot, and during this change it has absorbed both light and heat; for when it is removed from the fire, it continues for some time to give out both: but when it is cool it does not appear to have undergone any perceptible change, and the same process may be often repeated. If a piece of wood be treated in the same way, light and heat are also given out; but it is totally changed—the greater part is dissipated or passes off in the form of elastic fluids, and a small portion of ashes only remains. Sulphur raised to the temperature of 300° or 400°, enters into new combinations; and metallic substances, when subjected to different degrees of heat, are completely changed. Instead of possessing great tenacity and metallic lustre, they are generally reduced to the state of powder.

None of these changes can take place without atmospheric air or oxygen gas, which is one of the constituents of that elastic fluid; and in all cases of combustion, oxygen gas disappears or changes its constitution. Light and heat are emitted, and the combustible acquires new properties. In considering the phenomena of combustion, it has been always a question what share in the process is to be ascribed to the different agents which are necessarily concerned, and from what source the light and heat are derived. In one point, it is generally agreed, that the heat is given out by the oxygen gas, and it is that portion of caloric which is necessary to retain it in the elastic form. But different opinions have been held with regard to the source from which the light proceeds.

Among the alchemists, sulphur was regarded as the universal inflammable principle; and all bodies susceptible of combustion were supposed to contain a portion of that substance. Becher rejected that opinion, and admitted that sulphur contained the inflammable principle, but was not the principle itself. This theory was greatly improved by his pupil Stahl, who gave the inflammable principle the name of *phlogiston*, and hence arose what was long known by the appellation of the Stahlian or Phlogistic theory.

According to the theory of Stahl, phlogiston is supposed to exist in all combustible bodies, that is, in all bodies that can be burnt, and it is supposed to be the same in all. The diversity of appearance of combustion in different bodies is ascribed to their other elements, with which the common principle of inflammability or phlogiston is combined. Inflammation or combustion, is the gradual separation or dissipation of this principle, and then the body from which it has been separated is no longer combustible till it again combine with it.

These opinions prevailed about the middle of the 17th century, when Dr Hooke proposed a theory that air is the universal solvent of all combustibles; and this solution takes place when the temperature is raised. This solvent substance is said to be similar to that which exists in nitre or salt-petre. Pursuing this opinion, Mayow of Oxford introduced the denomination of *nitro-aërial particles*, which were necessary in combustion, and which, as the name indicates, exist in nitre. The phenomena of combustion, according to this theory, depend on the motion of these particles; and when the motion is rapid, light and heat are given out.

In the progress of chemical science, the imaginary principle of phlogiston was called in question. It was observed that substances exposed to the rays of the sun became inflammable; and having in this way acquired the principle of inflammability, phlogiston was supposed to be the same as light, or it was light fixed in bodies. It was observed, too, that the air in which a body is burnt is completely changed, and this change was ascribed to its combination with phlogiston; and hence the terms *phlogisticated* and *dephlogisticated*—the first denoting air combined with phlogiston, and unfit for supporting combustion; and the second expressive of pure air. In another step of the progress it was supposed that light and heat exist in the air; and during combustion the phlogiston combines with the air, while the light and heat are separated. According to another opinion, hydrogen is the principle of phlogiston; and the process of combustion is the combination of this principle with oxygen. Some other modifications of this theory were adopted, till it appeared that the combustible substance and oxygen gas were only concerned in the process. According to the views of Lavoisier, who first proposed the theory, and by whose name it was known, the light and heat are in combination with the oxygen in its elastic form, and the oxygen combining with the solid during combustion, the light and heat are separated. This theory has been also modified by later philosophers; and while they admit the oxygen gas to be the source of the heat, in consequence of its fixation in the body which has undergone the process of combustion, they suppose that the light is derived from the combustible.

In the process of combustion three modifications are distinguished, namely, *ignition*, *inflammation*, and *detonation*. The difference of effects observed in these modifications, seems to depend on the nature of the substances which undergo the change.

Ignition.—When a metallic substance, as a piece of iron, is exposed to a high temperature, it becomes red hot, and is said to be in a state of ignition—light and heat are given out; but when it is cooled, it returns to its former state without any perceptible change. But this is not to be considered as a true case of combustion. When a mass of iron is subjected to a still higher temperature, it is said to be in a state of incandescence or white heat.

Inflammation.—This modification of combustion is partly owing to the strong affinity of the body for oxygen, and partly to the slight affinity which exists between the particles of the combustible body. The burning of a candle or of sulphur, in the open air, affords familiar examples; but the same substances exposed to combustion in oxygen gas exhibit a more marked and more brilliant inflammation.

Detonation.—The third modification of combustion is detonation, in which an instantaneous inflammation, accompanied with explosion, is produced. This effect arises either from the sudden evolution of elastic fluids from the solid state, or from the sudden condensation of elastic fluids into the liquid state. Of the first, the explosion of gunpowder, in which an immense volume of elastic vapour is instantaneously formed, is a good example; and the inflammation of oxygen and hydrogen gases, which is attended with a violent explosion and great condensation, with the extrication of light and heat, is an instance of the last.

Products of combustion.—The result of all the processes of combustion is the formation of water, of an acid, or an oxide; when oxygen and hydrogen enter into combination, water is produced; when oxygen unites with sulphur, carbone, or phosphorus, the product is an acid; and when it enters into combination with metallic bodies, the new compound is called an oxide.

3. *Percussion.*—When two hard bodies, as in the case of flint and steel, are struck against each other, heat is given out. A piece of iron, by continued hammering, can be brought to a red heat. This production of heat, or increase of temperature, has been ascribed to the condensation of the particles. It is well known that the condensation or compression of air, produces so high a temperature, that combustible matters may be set on fire; and in the experiments of Dessaignes, it appears that not only air but liquids and solids give out both light and heat by sudden compression.

In some cases, bodies which are incombustible give out light and heat by percussion. Two hard stones produce this effect when they are struck against each other. The particles that are thrown off are raised to a high temperature, and brought to a state of fusion, owing perhaps to the condensation of the minute particles which are separated, but no actual combustion has taken place.

Oxygen Gas.

4. *Friction.*—A great deal of caloric is given out by friction. The intensity varies according to the nature of the substances employed, and the time that the friction is continued. When combustible substances are operated upon, they are set fire to; and the temperature of incombustible matters is raised so high, as to communicate fire to combustible bodies. When heat is produced by friction, the effect cannot be ascribed to an increase of density; for a great degree of heat is produced by rubbing the hand on a piece of soft cloth,—and even the waters of the ocean, when strongly agitated in a storm, indicate a rise of temperature. The heat produced by friction has been ascribed by some to a change in the specific caloric of bodies.

In the construction of machines it is of no small importance to select proper kinds of wood, because it has been found that different woods operating on each other by friction produce very different degrees of heat; and when the friction is continued in the direction of the fibres, a greater degree of heat is generated.

5. *Mixture.*—It is one of the characteristics of chemical action to produce a change of temperature; and this, it is obvious, arises from a change of bulk. When a body passes from the solid to the fluid state, it absorbs caloric; and when it changes from a fluid to a solid, it gives out heat. When ammonia and muriatic acid, in the state of gas, are combined together, a solid is formed, and heat is given out. Nitrous gas and oxygen gas united together form a liquid, which is also accompanied with the evolution of caloric. Similar effects are obtained by mixing two liquids, as, when sulphuric acid is added to water, the temperature may be raised as high as the boiling point of water. Heat is also given out when solids and liquids combine. Water poured upon well burnt limestone becomes solid, with a copious extrication of heat; and when the process is conducted in the dark, it appears that light is also emitted.

Electricity.—In many of their effects, electricity and galvanism, which are considered as modifications of the same power, have an obvious analogy to light and heat. Subjected to the action of these powers, bodies acquire a very high temperature; compounds are reduced to their elements, and the elements are brought into new combinations. Whether it be that a higher temperature is induced in the operation of electricity and galvanism, or whether it arise from any peculiar activity in these powers, the effects produced are in a much higher degree than can be obtained by the greatest artificial heat; and substances have been decomposed by means of galvanism, which the highest temperature yet attained could not effect. But although the history and effects of electricity and galvanism might, with no impropriety, be investigated in their general connection with light and heat, yet it would be an anticipation of the necessary detail of that department of science, which must be introduced under its proper head. See Electricity.

Chap. III. Of Oxygen Gas.

The word *oxygen* is composed of two Greek words, which signify *to make sour*, because, according to the chemical language proposed by the French philosophers, the base of oxygen gas is considered as the acidifying principle, that is, the base of oxygen gas, entering into combination with the various substances, forms an acid, as with sulphur, sulphuric acid, and with carbone, carbonic acid. Oxygen gas, or its base, oxygen, is one of the most important elements in chemical processes. It was discovered by Dr Priestley in 1774, and, from the prevailing theory, was denominated *dephlogisticated air*. It was called empyreal air, vital, and highly respirable air, by others.

Preparation.—Oxygen gas may be obtained by exposing to a red heat, red lead, or the red oxide of mercury, and collecting the gas as it passes off in vessels filled with water, and inverted on the shelf of the pneumatic trough. Nitre, or salt-petre, exposed to a red heat in an earthen ware or coated glass retort, also furnishes oxygen gas. It may be obtained likewise by introducing into a glass retort a quantity of the black oxide of manganese reduced to powder, adding an equal weight of sulphuric acid, and applying a moderate heat; but oxygen gas is most conveniently and most copiously procured by subjecting the black oxide of manganese, in an iron retort, to a red heat. By fitting a bent iron tube to the retort, by accurate grinding, or securing it with a lute, to prevent the escape of the gas, it may be collected in the usual way over water.

Process explained.—The black oxide of manganese is a compound of the metal and oxygen. When this compound is exposed to a high temperature, the force of affinity between a large proportion of the oxygen and the manganese is destroyed, and the matter of heat, or caloric, combines with the oxygen; a new compound is formed, and oxygen gas, an elastic fluid, appears. The nature of the process is the same when red lead, or the red oxide of mercury, is employed. Manganese combines with oxygen in two proportions; but sulphuric acid can only unite with the oxide of manganese in its lowest proportion; the other portion of oxygen gas is consequently separated when the sulphuric acid is added to a quantity of manganese; and as the acid in its new combination becomes solid, the caloric, which retained it in the liquid form, combines with the separated oxygen, and oxygen gas is obtained. This process furnishes an example of double affinity. When oxygen gas is obtained from nitre, the nitric acid, one of its constituent parts, is decomposed, and its oxygen appears in a separate form; but other elastic fluids are evolved at the same time, so that the oxygen gas prepared in this way is less pure than when it is obtained from manganese and some other substances.

Properties.—In its mechanical properties, oxygen gas resembles common air and other elastic fluids. It is invisible, colourless, and susceptible of indefinite expansion and compression, has neither taste nor smell; it is 740 times lighter than its bulk of water, and 100 cubic inches at the temperature of 60°, and, when the barometer stands at 30 inches, weigh about 34 grains. No perceptible quantity of oxygen gas combines with water. Combustible substances burn with greater rapidity and brilliancy in this gas than in common air, and animals live much longer by respiring a determinate portion of it. Oxygen gas is not less necessary for the germination of the seeds of plants.

Exper. 1.—Introduce a quantity of oxygen gas into a small jar or wide mouthed bottle, and let down into this vessel a lighted wax taper, or a splinter of wood in a state of inflammation, it will burn with great splendour till the oxygen gas is expended; and if the taper be blown out and again immersed in the vessel while any part of the wick is red hot, it re-kindles with a slight explosion.

Exper. 2.—Fasten a piece of charcoal to a copper wire, make the end of the charcoal red hot, and introduce it into a jar of oxygen gas, and beautiful sparks will be thrown off during the combustion.

Exper. 3.—Melt a quantity of sulphur in a small brass cup, and continue the heat till it is inflamed; in this state immerse it in a jar of oxygen gas, and a very rapid combustion, with a copious effusion of white light, will take place.

Exper. 4.—Put a small bit of phosphorus in a similar brass cup, set fire to it with a heated wire, and introduce it into a vessel of oxygen gas; the combustion proceeds with great rapidity, and the blaze of light is too splendid for the eye to bear.

Exper. 5.—Coil a piece of small iron wire round a glass rod, and having slipped it off suspend it in the spiral form from the end of a cork; to the other extremity of the wire fix a bit of thread, or a small bit of wood, and having dipped it in wax or melted sulphur, set fire to it, and immerse it in a jar of oxygen gas. The wire will burn with great brilliancy, and continue to throw off sparks till the whole is consumed, or the gas is exhausted. In this experiment the red hot globules of the iron as they drop on the bottom of the vessel are apt to fracture it. But this accident may be prevented by pouring in a little sand to form a layer at the bottom of the vessel. When the wire is very small the red hot globules are thrown off laterally, and produce the same effect on the sides of the vessel. The use of thicker wire is the best precaution against this accident.

Exper. 6.—Let a jar having a neck and opening at the top, furnished with a ground glass stopper, be filled with oxygen gas, and having suspended the brass cup by means of a wire from the end of the glass stopper, put a little sulphur in the cup, and having inflamed it as in the former experiment, introduce it into the jar, and secure the stopper tight in its place. The combustion will go on with great brilliancy, till the whole of the sulphur or the gas is consumed. During this process, the water will rise in the inside of the jar, and when the air has cooled will rise still higher, affording a proof that the confined oxygen gas, or part of it, has disappeared, or has assumed a different form.

These experiments furnish ample evidence of the remarkable property of oxygen gas supporting a more brilliant combustion than common air. This arises from its strong affinity for the combustible body. The last experiment shews that it has entered into some new form; and the same thing would have appeared in the other experiments, if they had been conducted in the same way, excepting in the combustion of charcoal; the product obtained, which is carbonic acid, is nearly of the same bulk with the oxygen gas which has entered into the new combination. The sulphur and phosphorus which undergo combustion in oxygen gas, are converted into acids which appear in the liquid form, and the iron in its new combination is changed to the state of oxide.

Oxygen gas forms one of the constituent parts of atmospheric air, and the processes of combustion and respiration depend entirely on the proportion of this gas with which it is combined.

Chap. IV. Of Azotic Gas.

The word *azote*, or the base of azotic gas, is of Greek origin, and is expressive of its unfitness for the support of animal life.

Preparation.—Azotic gas may be obtained by taking a quantity of muscular flesh, or the fibrous part of the blood, and after being well washed, cut it into small bits, put it into a retort or a matrass, with a ground tube, and pour over it diluted nitric acid, exposed to the heat of about 100°, and collect the air as it escapes through the tube in proper vessels in the pneumatic apparatus. If the substance called sulphuret of potash be exposed to a determinate quantity of the air of the atmosphere enclosed in a bell glass over water, or if sulphuret of iron be formed into a paste with water, and treated in the same way, in the course of a few days the air within the glass is diminished, and what remains is azotic gas. Phosphorus exposed to the action of a confined portion of atmospheric air, also abstracts the oxygen and leaves the azotic gas behind.

Properties.—Azotic gas possesses the mechanical properties of common air; 100 cubic inches at mean temperature and pressure, weigh nearly 30 grains; it is altogether unfit for the support of combustion or of respiration; and it is absorbed only in small proportion by water.

Exper. 1.—Introduce a lighted taper into a jar filled with azotic gas, and the moment that the flame comes in contact with the gas it will be extinguished.

Exper. 2.—Prepare two jars, one of which is filled with oxygen gas and the other with azotic gas; immerse a lighted taper in the azotic gas, and the moment it is extinguished, plunge it into the oxygen gas and it will be rekindled, with an explosion, as in a former experiment. The same may be repeated several times, the taper will be extinguished in the one, and lighted up in the other.

Azotic gas is to be considered as a compound of its base, azote, and caloric, on which it depends for its elastic form; but it enters into combination with oxygen, and affords several very important compounds.

Sect. I. *Atmospheric Air.*

Common air, as it is called, or the air of the atmosphere, is a compound of oxygen and azotic gases. If a mixture of about four measures of azotic gas, and one of oxygen gas, be prepared, the product resembles atmospheric air in all its properties, and is equally fit for the support of combustion and respiration. The proportions of the two gases in atmospheric air are, 79 of azotic gas and 21 of oxygen gas by bulk; or by weight, 74 of azotic

Azotic Gas.

gas and 26 of oxygen gas. These proportions are uniform and constant in all parts of the world, in the coldest and the warmest climates, in places where the air is supposed to possess the highest salubrity, as well as in places where a great deal is consumed in the processes of combustion and respiration, and where it might be expected to be diminished in purity. This uniformity of the proportions of the constituent parts of the atmosphere, presents a decisive proof that it is to be considered as a chemical compound. The weight of 100 cubic inches of atmospheric air is about 31 grains; it is about 816 times lighter than an equal bulk of water, at the temperature of 60°, and when the barometer stands at 30 inches, and the pressure of the air of the atmosphere is nearly equal to fifteen pounds on every square inch.

The processes of combustion and respiration are supported by the air of the atmosphere only in proportion to the oxygen gas which it contains.

Exper.—If a quantity of common air be confined in a jar which is furnished with a ground stopper, and if phosphorus, in a state of inflammation, be introduced, as in a former experiment, the combustion will be much less brilliant than in the oxygen gas, and will cease entirely when about one-fourth of the air within the jar is consumed, as will appear from the the water rising to that height in the inside.

Sect. II. *Nitrous Oxide Gas.*

Preparation.—If a quantity of the salt called nitrate of ammonia be put into a glass retort, and heat applied between the temperature of 340° and 500°, the salt melts, and after it has become liquid it gives out a great quantity of white fumes, which may be received in jars over water. After standing for some time the gas becomes quite transparent; in its physical properties it resembles common air; 100 cubic inches weigh nearly 49 grains, and its constituent parts are 63 parts of azotic gas, and 37 of oxygen gas.

The taste of this gas is sweetish, and the odour is agreeable; water absorbs more than half its bulk and acquires a sweetish taste; and by boiling, the whole of the gas may be expelled unchanged.

Some combustible bodies burn nearly with the same brilliancy as in oxygen gas, but they must be in a state of ignition before they are introduced. A burning taper at first exhibits a splendid white light, and as the process advances the flame gradually lightens. The combustion of phosphorus is little inferior to the same process in oxygen gas.

Effects when respired.—When this gas is respired, its effects on the nervous system are in some degree analogous to those of intoxicating liquors; highly pleasureable feelings are induced; a peculiar thrilling sensation diffused over the whole frame is experienced; and hence it has been denominated *Gas of Paradise.* On different constitutions its effects are different, and although it may be respired for three or four minutes with impunity, yet it is unfit for the support of animal life.

Sect. III. *Nitrous Gas.*

Preparation.—If a quantity of copper-wire or copper-filings, or other metal, be put into a retort, and diluted nitric acid be added, a violent action takes place, and a great quantity of gas, which may be collected in jars over water, is evolved. This is nitrous gas. In this process the nitric acid, which is a compound of nitrous gas and oxygen, is partially decomposed; a portion of the oxygen combines with the metallic substance and forms an oxide, and another portion of the acid unites with this oxide, forming a neutral salt, while the nitrous gas, combining with the caloric that is given out during these changes, passes off in the form of elastic fluid. Nitrous gas was known to Dr Hales, but the examination of its properties was prosecuted by Dr Priestley.

Hydrogen Gas.

Properties.—Nitrous gas is an elastic, colourless fluid, without any sensible taste, produces no change on vegetable blues, which is the test of acidity; 100 cubic inches weigh 34.26 grains; it consists of nearly 56 parts oxygen, and 44 parts of azote; and it is altogether unfit for respiration.

Some combustible substances burn in nitrous gas, but others are extinguished. The combustion of phosphorus in a state of active inflammation, is almost equally brilliant as in oxygen gas; and Homberg's pyrophorus, a substance which inflames spontaneously in the open air, becomes instantly red, and burns very vividly. In these processes the oxygen of the nitrous gas combines with the combustible, and azotic gas remains behind. Water absorbs from one-tenth to one-twentieth of its bulk of this gas at the common temperature, but when it is boiled or frozen the gas separates unchanged.

Exper. 1.—To a jar of nitrous gas over water add slowly and in repeated portions a quantity of atmospheric air; when the two gases unite, a red colour appears, the bulk is diminished, and heat is evolved.

Exper. 2.—Instead of atmospheric air, let a quantity of oxygen gas be admitted to the jar of nitrous gas, a similar diminution of bulk will follow every addition of the gas; and if too great a proportion of oxygen gas be not introduced, the whole will be converted into the state of liquid.

In these experiments the nitrous gas combines with another portion of oxygen, and is converted into nitrous acid, which, as it assumes the state of liquid by the condensation of the two gases, gives out heat.

The compounds of oxygen and azotic gases present a fine illustration of the effects of chemical combination, in the diversity of products obtained by the different proportions of the two constituent parts. In 100 parts of atmospheric air there are 26 by weight of oxygen gas, and this affords a compound with azotic gas, which is not only salutary, but absolutely necessary for the support of animal life; when the proportion is increased to nearly 37 parts of oxygen gas, the compound, nitrous oxide, may be respired for a short time without injury, but when it is increased to 56 or 70 parts, as in nitrous gas and nitrous acid, the compounds have acquired properties which render them noxious to animal life, producing instant suffocation when they are respired.

Chap. V. Of Hydrogen Gas.

The name of this gas, derived from the Greek, indicates that it is one of the constituent parts of water; its combustible property is noticed in the writings of some of the older chemists, and in 1766 its properties were particularly examined by Mr Cavendish.

Preparation.—Put a quantity of iron filings, or granulated zinc, into a glass retort, and add sulphuric acid, previously diluted with 5 or 6 times its bulk of water; a violent action takes place, with the extrication of a great quantity of elastic fluid, which may be collected in jars over water. This is hydrogen gas, or, as it was formerly denominated, *inflammable air*.

In this process various chemical affinities are brought into action. The sulphuric acid combines with the metal, and forms with it a neutral salt; but the metal must be previously in the state of oxide, and it derives its oxygen from the water, while the hydrogen, the other constituent element of the water, uniting with the caloric which is separated in some of these changes, appears in the form of elastic fluid or hydrogen gas.

Properties.—Hydrogen gas possesses the same physical properties as common air, but it is the lightest of all gaseous substances; one hundred cubic inches, at mean temperature and pressure, weigh only about two grains and a quarter; it is unfit for respiration and for the support of combustion, and it has no perceptible taste, but the odour is peculiar, and somewhat disagreeable. Hydrogen gas is but slightly absorbed by water.

Exper. 1.—Fill a jar with hydrogen gas, and apply a lighted taper to its mouth, the gas will take fire with a slight explosion where it is in contact with atmospheric air, and will continue to burn with a lambent flame till the whole is consumed. The combustible property of the gas is illustrated by this experiment.

Exper. 2.—Immerse suddenly into a tall jar filled with hydrogen gas a burning taper; the gas will be kindled at the surface, but the taper, as it is plunged deeper, will be extinguished, affording a proof that this gas is unfit for the support of combustion. The same thing may be shewn by suddenly inverting a jar filled with hydrogen gas over a burning candle, which is immediately extinguished.

Exper. 3.—Fill two jars with the gas, keep the one in an inverted position, and hold the other with its mouth upwards for a few minutes; if a lighted taper be applied to each of the jars, it will be found that the whole of the gas has escaped from the latter, but not from the former, in consequence of its being so much lighter than the air of the atmosphere. The low specific gravity of this gas renders it peculiarly proper for filling air-balloons, for which purpose it is employed. In the common way of procuring hydrogen gas it is about 7 or 8 times, but when pure 12 or 13 times, lighter than the same bulk of atmospheric air.

Sect. I. *Water.*

In the progress of chemical science in modern times, various opinions were held, both by French and British chemists, of the nature of the product obtained by the combustion of oxygen and hydrogen gases. The experiments of Mr Cavendish, which were made about the year 1781, led to the conclusion that water is the result of this combustion; and this was finally confirmed by the experiments of Lavoisier, and his associates, which were conducted on a very large scale. This fortunate discovery may be considered as one of the most important in the whole range of chemical science.

The proportions of the two elements which enter into the composition of water, are two parts of hydrogen to 15 of oxygen by weight, or two of hydrogen to one of oxygen by bulk. These proportions have been ascertained by experiment.

Exper. 1.—If two measures of hydrogen gas and one measure of oxygen gas be introduced into a phial, and set fire to, a violent explosion is produced; and if the experiment be made over mercury, the gases disappear, and water is formed. When the gases are exploded in a phial held in the hand, it ought to be wrapt round with a towel, and firmly grasped with both hands, by which all danger from the bursting of the phial is precluded.

Exper. 2.—If a similar experiment is made with atmospheric air, in place of oxygen gas, the oxygen gas of the air disappears, and the azotic gas remains behind.

Exper. 3.—If the vapour of water be passed through a red-hot gun barrel, or a porcelain tube, with a quantity of iron-filings, or small pieces of iron, the water will be separated into its constituent parts, the oxygen will combine with the iron, and the hydrogen gas will pass off, and may be collected in proper vessels.

Exper. 4.—The decomposition of water is easily effected by means of galvanism. If the opposite wires of a galvanic battery be made to complete the circuit within a small glass tube filled with water, the water is separated into its elements; the oxygen gas is given out from the positive wire, and hydrogen from the negative wire; and if wires of platina be employed, both gases may be collected either in the same tube or separately. If they are collected in the same tube, and again exploded by a spark, by bringing the wires into contact, the two gases return to the state of water. This experiment shews both the decomposition and composition of water.

Exper. 5.—If hydrogen gas be admitted from a gas-holder, by a very small current, into a large glass vessel filled with common air, and set fire to; by the slow combustion a thin vapour will soon dim the inside of the glass; and as it is condensed on the sides of the vessel, which should be covered with wet cloth on the outside, and kept cool by the application of cold water, it will soon collect into drops and trickle down the sides of the glass. In the course of an hour a perceptible quantity of water may be obtained.

A cubic foot of water, at the temperature of 55°, weighs 998.74 avoirdupois ounces, of $437\frac{1}{2}$ Troy grains each. Water exists in three different states—in the solid state or ice, in the liquid, and in that of vapour or steam. When water is cooled down to the temperature of 32°, it becomes solid. Assuming in this state a crystalline form, the crystals crossing each other at angles of 60° or 120°, it increases in bulk from the new arrangement of its particles, and exerts a prodigious expansive force. The specific gravity of ice is consequently less than that of water. When the temperature rises above 32°, caloric is absorbed, and the ice returns to the liquid state. Water possesses the singular property of reaching its maximum of density at the temperature of about 42°, and not, as it might be expected, as it approaches more nearly to the freezing point. But when the temperature is raised to the boiling point or 212°, the whole is converted into an elastic invisible fluid, which is known by the name of vapour or steam. This remarkable change in the constitution of water, is owing to the absorption of a quantity of caloric, and such a quantity as would have raised the water, if no change had taken place, to the temperature of nearly 1000°. In the state of steam, the water has increased 1800 times in bulk, from which its expansive force must be prodigious, and hence its application as the moving power in the steam-engine.

Sect. II. *Ammonia.*

The combination of hydrogen with azote, affords an important compound. No change takes place when hydrogen and azotic gases are mixed together; and indeed no process is yet known by which a direct combination of the two gases can be obtained; but when they are brought together in the moment of evolution from the bodies with which they were formerly combined, or in their nascent state as it is called, they unite and form ammonia. But for an account of the properties of this substance, we must refer to its proper place among the alkalies.

Chap. VI. Of Carbone.

It was conjectured by Sir Isaac Newton, that the diamond, from its great refractive power, is a combustible substance. Repeated experiments have fully confirmed the conjecture of that sagacious philosopher; and to this combustible matter the name of carbone is assigned in the modern chemical nomenclature. The diamond, then, is supposed to be carbone in its crystallized state, and in the purest form in which it is found to exist. Some experiments indeed seem to lead to the conclusion that it contains a small portion of oxygen; and, according to others, its refractive power is increased by a portion of hydrogen which enters into its composition.

The diamond is the hardest and most indestructible substance in nature; is remarkable for its brilliancy; has the property of absorbing light, for when it is exposed to the sun's rays and carried into a dark place, it is luminous; and it is a non-conductor of electricity, for it becomes sensibly electric by friction.

The combustible property of the diamond has been established by numerous experiments; and the product of that combustion being examined, the quantity of carbonic acid gas, which is a compound of carbone and oxygen, is exactly equal to the proportion of the diamond and the oxygen gas consumed. These experiments were generally made by exposing a portion of diamond in oxygen gas, to the action of a burning-glass. A striking analogy was thus observed between the diamond and charcoal, from the combustion of which a product of the same nature is obtained; but the one is a compound, and the other a simple substance. Charcoal, which is composed of carbone and oxygen, is a black, porous, light substance, and burns in the heat of an ordinary fire. But the diamond is a brilliant, extremely hard body, and requires for its combustion a temperature not less than 5000°.

It was proved by the experiments of Guyton Morveau, that carbonic acid is composed of 17.88 diamond, and of 82.12 oxygen, in 100 parts; and according to the experiments of Lavoisier, 28 parts of charcoal require only 72 parts of oxygen to produce 100 parts of carbonic acid. From these experiments it appears, that carbonic acid is obtained by the combustion both of the diamond and charcoal; but as the latter requires a smaller proportion of oxygen to make up the 100 parts of carbonic acid, it must contain the difference of the quantity of oxygen, between the quantity with which it combines and the quantity necessary to convert the diamond into the same acid. Thus charcoal requires only 72 parts of oxygen, but the diamond requires 82.12; and hence the difference of 10.12 parts must have been previously combined with the charcoal before combustion. According to this statement, the 28 parts of charcoal are composed of 17.88 diamond and 10.12 oxygen. But it ought to be noticed, that the result of other experiments fixes the amount of charcoal at 24 parts only in the 100 parts of carbonic acid.

Sect. I. *Charcoal.*

Charcoal is to be considered, from the experiments already alluded to, as a compound of carbone or diamond, and oxygen; and as this compound possesses no acid properties, it is distinguished by the name of oxide.

Preparation.—Charcoal is prepared in the large way by a kind of smothered combustion, or by exposing it to a high temperature, and at the same time by excluding the air as much as possible. But for the purpose of experiment, small slips of wood may be introduced into a crucible, which is to be filled up with sand, and exposed to the greatest heat of a wind furnace. If the charcoal be required in the state of powder, it may be purified by washing it with diluted muriatic acid, and then with a large portion of pure water.

Properties.—Charcoal thus prepared, in the solid state, is a black brittle substance, without taste or smell, conducts heat slowly, but is a good conductor of electricity, is insoluble in water, but readily absorbs moisture and air. It resists the putrefaction of animal substances, and removes the offensive smell from tainted flesh or putrid water. It is employed as an excellent tooth powder. Charcoal is quite indestructible. Stakes charred on the outside, which seems to have been a common practice with the ancients, have remained in the ground for some thousand years in the most perfect preservation.

Exper. 1.—Let a jar be filled with common air over mercury, and having made a piece of charcoal red hot, plunge it under the surface of the mercury till it is cold, and introduce it under the jar; a diminution of the bulk of the gas is immediately observed, in consequence of the absorption of the air by the charcoal, and the mercury rises in the jar. But if a little water be afterwards introduced, the charcoal absorbs the moisture and gives out the air, and then the mercury is again depressed.

Exper. 2.—If pure charcoal be raised to a red heat, and introduced into a jar filled with oxygen gas, it burns rapidly, and throws out brilliant sparks, but with little flame; the charcoal disappears if the quantity of gas be sufficient, and the oxygen gas is totally changed in its properties; for it is converted into carbonic acid, which is a compound of carbone and oxygen. The bulk of the gas originally employed is not materially changed, but the combination of carbone gives it a greater degree of density.

Sect. II. *Carbonic Oxide Gas.*

Carbone and oxygen unite in different proportions; and to one of these compounds which was particularly examined by Mr Cruickshank of Woolwich, the name of gaseous oxide of carbone, or carbonic oxide gas, has been given. It contains a smaller proportion of oxygen than what exists in carbonic acid.

Preparation.—If carbonic acid gas be passed through red hot charcoal in an iron or porcelain tube, the carbonic acid is decomposed, part of the oxygen combines with the charcoal in the tube, and carbonic oxide gas is formed. It may be obtained also by subjecting to a strong heat one part of pure charcoal, with three parts of chalk, or any other carbonate; and may be purified from any portion of carbonic acid with which it is mixed, by washing it with lime-water.

Properties.—Carbonic oxide gas possesses the physical properties of common air; 100 cubic inches weigh 30 grains; water absorbs about one-tenth of its bulk; it is unfit for respiration; but it is combustible, and burns on the application of an inflamed body, with a lambent blue flame. It is neither inflamed nor diminished by the electric spark; but if passed through a red hot tube full of air, slight detonations take place, and the residue of this combustion is carbonic acid and azote; so that the oxygen of the atmosphere has united with the carbonic oxide and has formed carbonic acid, while the azotic gas is set free.

Exper. 1.—If two measures of carbonic oxide gas be mixed with one measure of oxygen gas, and the electrical spark be passed through the mixture, the product of the combustion is two measures of pure carbonic acid.

It has been supposed by some, that it may be owing to this gas disengaged from burning charcoal, that sudden death is often induced in close apartments.

Sect. III. *Carburetted Hydrogen Gas.*

Carbone enters into combination with hydrogen, and forms with it two distinct compounds, one of which is called carburetted hydrogen gas, and the other super-carburetted hydrogen gas or olefiant gas.

Carburetted hydrogen gas.—If the saline substance called acetate of potash, which is a compound of acetic acid and potash, be exposed to a red heat, the vegetable acid, consisting of carbone, hydrogen, and oxygen is decomposed, and the carbone and part of the hydrogen unite and form carburetted hydrogen gas, which may be collected in proper vessels over water. The same gas may be obtained by the distillation of common pit-coal; and it is by this process that the inflammable air which supplies the gas lights is prepared. To render it pure, it should be washed with lime-water, to separate the carbonic acid with which it is mixed. This precaution is also necessary in the economical application of the gas from coal.

The decomposition of vegetable matters affords a copious evolution of the same gas; and accordingly it is given out in great abundance from stagnant waters during the hot season of the year.

Properties.—Carburetted hydrogen gas has no taste, but the smell is peculiar and disagreeable; 100 cubic inches weigh about 17 grains; and water absorbs about one-thirtieth part of its bulk. It burns with a bright yellowish flame.

Exper. 1.—If one measure of this gas and two measures of oxygen gas, be inflamed over mercury by the electric spark, the whole is converted into carbonic acid and water. One measure of carbonic acid gas is obtained.

In this experiment part of the oxygen combines with the hydrogen of the carburetted hydrogen gas, and forms water; and another part of the oxygen unites with the carbone and forms carbonic acid.

Super-carburetted hydrogen gas.—If a mixture of four parts of oil of vitriol or sulphuric acid, with one part of strong spirits of wine be heated in a retort, a gas is obtained, which has received this name from the larger proportion of carbone which enters into its composition. It may be collected over water; and to render it pure it is found necessary to wash it.

Properties.—This gas has a peculiar disagreeable odour; it is 13 times heavier than hydrogen gas; 100 cubic inches weigh nearly 30 grains, water absorbs about one-eighth of its bulk; it burns with great splendour, and with a beautiful white flame; and this gas, as well as the former, is unfit for respiration.

When this gas is mixed with oxymuriatic gas or chlorine, the bulk is diminished, and if mixed in nearly equal proportions the whole is condensed into a peculiar fluid, which has somewhat the appearance of an oil; and hence the name of olefiant gas by which the Dutch chemists who first described it in 1794, distinguished it.

Carburetted hydrogen gas was formerly denominated light inflammable air and heavy inflammable air, as it was found to differ in its specific gravity according to the nature of the substance from which it was obtained, and the process employed. But the experiments of later chemists have shewn that this difference is owing to mixtures of olefiant gas, carbonic oxide, and hydrogen gases with the carburetted hydrogen gas.

Chap. VII. Of Phosphorus.

This singular substance was discovered by Brandt of Hamburgh, about the year 1669, while he was engaged in searching for the philosophers stone. Kunkel and other chemists having seen the new product, and having obtained, it is said, some hints of the nature of the process by which it was obtained succeeded in the discovery. Mr Boyle who is also considered one of the discoverers of phosphorus, communicated the secret to the Royal Society in 1680, and instructed Godfrey Hankwitz, a London apothecary, in the mode of preparing it, who supplied all Europe for several years with phosphorus; and hence it was known under the name of *English phosphorus*. An important discovery was made in 1774, by Gahn and Scheele, that phosphorus is contained in the bones of animals; and this discovery greatly facilitated the processes for its preparation.

Preparation.—Having reduced a quantity of burnt bones to powder, put 100 parts into a porcelain or stoneware basin, dilute it with four times its weight of water, and add 40 parts of sulphuric acid in small portions, stirring the mixture; after every addition a violent effervescence takes place, and a great deal of air is given out. The mixture should remain for a day or two, and should be occasionally stirred to expose every part of the powder.

The nature of this process may be understood by considering that bones are chiefly composed of lime united to phosphoric and carbonic acids; but the sulphuric acid having a stronger affinity for the lime, than either the phosphoric or carbonic acids, separates these two acids, one of which remains in the liquid, and the other, the carbonic acid, passes off in the state of gas, while the sulphuric acid and the lime form an insoluble compound, and fall to the bottom.

Filter the liquid through cloth, and having repeatedly washed the sulphate of lime that remains upon it, add to the liquid which has passed through the cloth a solution of nitrate of lead in water, as long as any precipitation is formed. Pour the whole again upon a filter, and let the white powder which remains be well washed and dried. Mix the dried powder with one-sixth of its weight of charcoal dust, and put the mixture into an earthen ware retort, which should be previously coated to resist the strong heat to which it must be exposed. To the beak of the retort it may be necessary to apply a long tube, well secured at the joinings, and the extremity of which is to be kept under water. After the heat is applied, a great deal of gas is given off, which inflames spontaneously as it reaches the surface of the water; a substance at last somewhat similar to melted wax drops out, and congeals under the water. This substance is phosphorus. It is farther purified by straining it through chamois leather, while it is melted under water, and it is formed into sticks by putting it into a glass funnel with a long tube, immersing it in boiling water, and when the phosphorus is melted and flows into the tube, it is suddenly plunged in cold water to make it congeal. It should be preserved in close vessels filled with pure water, and excluded from the light.

Properties.—Phosphorus is nearly of the consistence of wax, semi-transparent, has an acrid disagreeable taste, and a peculiar offensive smell, somewhat resembling garlic. The specific gravity is 1.77; when the air is excluded it becomes liquid at 99°, and boils at 554°. At the temperature of 44° it gives out a white smoke, and is luminous in the dark; but when the temperature is raised to 148°, it takes fire, burns with a bright flame, and throws off a great deal of dense white vapour.

Exper. 1.—Write a word on a board with a stick of phosphorus, and carry it into a dark room; it will appear luminous, particularly if the temperature of the room be not very low.

Exper. 2—Take a thin slice of phosphorus, and having dried it well with a cloth, wrap it up in a bit of paper, and rub it smartly with a bit of dry soft wood; the temperature will be so much raised by the friction as to inflame it.

Exper. 3.—Wrap up a bit of phosphorus well dried in a little cotton, and place it under the receiver of an air-pump. When the air is exhausted to a certain degree, the phosphorus will take fire.

In all experiments with phosphorus, the precaution should be carefully observed of never touching it with the fingers.

Sect. I. *Oxide of Phosphorus.*

Exposed to the light, or kept in water not entirely freed from air, phosphorus soon loses its transparency, becomes white, and is afterwards covered with a dark brown crust. This is the lowest degree in which phosphorus combines with oxygen, and the compound is called an oxide of phosphorus. This change shews that it is necessary to keep it excluded from the air and light, and for this purpose the water in which it is preserved should be boiled, and the vessels containing it should be kept in a dark place. It is easy to purify phosphorus from this oxide, by melting it in water; at the temperature of about 100°, the oxide separates and swims on the surface.

Phosphoric matches.—Put a small bit of phosphorus into the bottom of a long narrow glass tube, and expose it to the heat of boiling water; the phosphorus becomes luminous and rises in the form of a white vapour, which attaches itself to the sides of the tube. This also is an oxide of phosphorus, which readily takes fire with a moderate heat; and for this purpose it is employed to communicate a light to sulphur matches, merely by taking out a little of it and exposing it to the air. To render it more combustible, a small portion of oil or sulphur is added to the phosphorus.

Acids.—When phosphorus is burnt in common air confined in a vessel, a rapid combustion takes place, a great quantity of white fumes is produced, and these fumes being mixed with water exhibit acid properties. This is phosphorous acid, in which the oxygen is in smaller proportion than the phosphoric acid.

But if phosphorus, in a state of inflammation, be introduced into a jar of oxygen gas, the combustion is more splendid, the evolution of the white fumes is more copious, and a concrete substance is formed, which adheres to the sides of the jar. The product of this combustion is phosphoric acid, to be afterwards treated of.

When phosphorus is kept for some time in azotic gas, a small portion is dissolved, and the azotic gas being saturated with the phosphorus is increased about one-fortieth part of its bulk, and the compound is called phosphuretted azotic gas, which becomes luminous when it is mixed with oxygen gas; but the combustion is more brilliant when the phosphuretted azotic gas is gradually let up into a jar of oxygen gas.

SECT. II. *Phosphuretted Hydrogen Gas.*

Phosphorus enters into combination with hydrogen when it is kept for some hours in a jar exposed to its action. A small portion of phosphorus is dissolved, and when the phosphorised gas, as it is called, is introduced into a jar of oxygen gas, a brilliant bluish flame fills the whole vessel. The same effect is not produced in atmospheric air. This gas has a slight smell of garlic.

Phosphuretted hydrogen gas was discovered by M. Gengembre in 1783, by boiling phosphorus in a solution of pure potash, in a small retort, and collecting the gas in vessels over water. It may be prepared also by melting phosphorus by means of a burning glass, in a jar of hydrogen gas standing over mercury. But this gas may be obtained more easily, by taking about an ounce of slaked quicklime, and 30 grains of phosphorus, and having reduced the whole to a soft paste with a little water, introducing it into a small glass or stone-ware retort, the body of which should be filled with the materials. The beak of the retort being immersed in water, and heat applied, the gas begins to pass over, and when the bubbles come to the surface they explode with flame and smoke. By another method of preparing this gas, phosphuret of lime, which is a compound of phosphorus and lime, is put in small pieces into a retort filled with water, to which a small portion of muriatic acid has been added, and as it is given off it is collected over water in the usual way.

In all these processes a decomposition of the water takes place; part of the phosphorus combines with the oxygen, and forms phosphoric acid, which unites with the potash or lime; and another part of the phosphorus uniting with the hydrogen of the water, passes off in the state of phosphuretted hydrogen gas.

Properties.—In its physical properties this gas resembles common air; it is colourless, smells like putrid fish, has a very bitter taste, and at the mean temperature and pressure of the atmosphere 100 cubic inches weigh $27\frac{1}{2}$ grains. When kept over pure water it remains unchanged.

But the most remarkable property of this gas is its spontaneous inflammation when it comes in contact with the air of the atmosphere. When the gas passes off slowly, the bubbles are of a larger size, and when they reach the surface they exhibit an elegant appearance, forming after explosion a beautiful coronet of white vapour, which rises with an undulatory motion in still air. When it is brought in contact with oxygen gas the combustion is still more rapid and more brilliant. If a quantity of the gas, to the extent of two or three ounces, be collected in a small jar, and if it be removed from the shelf of the pneumatic apparatus on a saucer, and turned with its mouth upwards, the moment the saucer is removed the whole bursts into a copious flame.

In the combustion of this gas, phoshoric acid and water are formed. The phosphorus held in solution by the hydrogen gas combines with the oxygen, and forms phosphoric acid, while the hydrogen unites with another portion of the oxygen gas of the atmosphere, and forms water.

SECT. II. *Phosphuret of Carbone.*

Phosphorus enters into combination with carbone, and forms with it a compound which is denominated phosphuret of carbone. This substance is said to be produced during the distillation of phosphorus, and it remains behind on the leather through which it is strained to purify it. It is of a reddish colour, and does not melt like pure phosphorus. When it is distilled with a gentle heat, a small portion of phosphorus is separated, and what is supposed to be the phosphuret of carbone, which requires a very powerful heat for its decomposition, remains behind, and is in the form of a flocculent powder, of a lively orange red colour. Subjected to red heat, the phosphorus is driven off, and the charcoal remains; and when it is placed on a heated metallic plate, it burns rapidly in the open air. But some chemists suppose that the charcoal is merely mixed with the phosphorus, or in triple combination with oxygen and hydrogen.

CHAP. VIII. OF SULPHUR.

Sulphur is a simple combustible substance, which is universally diffused in nature, but it is most commonly in combination with mineral, vegetable, or animal matters. It exists in some mineral waters, and is met with in great abundance in volcanic countries, where it becomes a valuable commercial commodity.

Properties.—Sulphur, as it is purified by art, is a hard brittle substance, of a yellow colour, always opaque, and becomes electric by friction. The specific gravity is double that of water; it has no smell, and little taste. It is volatilized by rubbing, and diffuses a peculiar and slightly fetid odour. It is insoluble in water.

If a roll of sulphur be held for a little in the hand, it begins to crackle, and at last breaks to pieces. When sulphur is exposed to heat in close vessels it rises in the form of a fine powder, which is well known by the name of flowers of sulphur. When heated in contact with the air, and raised to the temperature of 300°, it becomes gradually thick and viscid, and if it be then poured into cold water it retains its softness, and is employed for taking impressions of seals or medals. But when the temperature is kept at that of boiling water, it retains its transparency, changes to a brownish red colour, and if it be permitted to cool slowly, crystallizes in the form of prismatic needles. But better crystals are obtained by pouring out part of the liquid sulphur as soon as the surface becomes solid.

When sulphur is burnt in the open air it gives out a pale blue flame, with a great quantity of white suffocating fumes; and if it be heated in dry oxygen gas, it burns with a violet coloured flame, and sulphurous acid gas is the product. But when a larger portion of oxygen combines with the sulphur, sulphuric acid is formed.

SECT. I. *Sulphuretted Hydrogen Gas.*

Sulphur enters into combination with hydrogen, and forms with it a gaseous compound. This gas may be prepared by subliming sulphur in dry hydrogen gas in a retort, or by pouring diluted sulphuric acid on a mixture of three parts of iron filings, and two parts of sulphur, that have been fused together in a crucible; and as it is rapidly absorbed by water it should be collected in vessels over mercury.

Properties.—This gas, formerly called *hepatic* gas, is colourless, and possesses the physical properties of common air; the smell is extremely fœtid; it is unfit for respiration or for supporting combustion; 100 cubic inches weigh about 36 grains; and it burns with a reddish blue flame, and deposits sulphur. Water absorbs more than its own bulk of this gas, which communicates to it a fœtid odour, and a nauseous, somewhat sweetish, taste. This water reddens vegetable blues, and has other properties of an acid. When it is exposed to the air the hydrogen gas escapes, and sulphur is deposited. It is from this deposition that sulphur found near mineral springs is derived. The constituent parts of sulphuretted hydrogen are about 71 parts of sulphur and 29 of hydrogen.

Sect. II. *Sulphuret of Carbone.*

The compound of sulphur and carbone is a substance which possesses peculiar properties; and in particular is remarkable for its volatility, and consequently for its power of producing cold. It was originally examined by the French chemists, and more lately by others.

Preparation.—A porcelain tube, passed through a furnace in an inclined position, is filled with charcoal; to the lower extremity of the tube a glass tube is luted, and its other end terminates in a vessel of water; to the other extremity of the porcelain tube is luted another glass tube, sufficiently wide to contain small bits of sulphur, which are to be pushed successively into the porcelain tube, with an irod rod passing through the cork which closes the end of the tube. The porcelain tube with the charcoal is made red hot, and pieces of sulphur are pushed slowly forward into the tube; the sublimed sulphur acts on the charcoal; a liquid of a yellow appearance passes through the tube; and the heat being continued, this liquid evaporates, and is condensed in the water of the vessel in which the tube terminates, and collects at the bottom. In the management of this process the sulphur should not be exposed suddenly to a strong heat; but the pieces of sulphur should be gradually introduced, that the vapour may not pass too rapidly through the tube.

Properties.—When first prepared the colour is yellowish; but after distillation, at a temperature not much exceeding 100°, it becomes quite transparent and colourless; the taste is acrid, and the smell pungent and disagreeable. The sulphuret of carbone is heavier than water, but it is nearly insoluble in that liquid; evaporates readily at the ordinary temperature of the atmosphere, and when the heat is raised to a little above 100° it boils; it burns with great facility and with a bluish flame; but when it is mixed with oxygen gas, and brought in contact with a burning body, it explodes with great violence, and, if the quantity of oxygen gas be sufficient, the whole is converted into carbonic acid. The constituent parts are 85 of sulphur and 15 of carbone.

Exper. 1.—The most remarkable property of the sulphuret of carbone, is its extreme volatility. If a quantity of this liquid, in a vessel of water, be placed under the receiver of an air-pump and the air exhausted, it rises through the water in the gaseous form; and when the pressure of the air is restored, it returns to the liquid state.

Exper. 2.—Put a little of the liquid itself, along with a thermometer, under the receiver of an air-pump, and let the receiver be quickly exhausted, the thermometer will sink in a few minutes 70° or 80° below 0°.

Exper. 3.—If the bulb of a thermometer be covered with fine lint, and after being immersed in the liquid, exposed to a current of air, the mercury will sink from 60° to 0°.

Sect. III. *Sulphuret of Phosphorus.*

Sulphur and phosphorus unite together in various proportions; and in whatever proportions they are combined, the compound becomes liquid at a much lower temperature than either of the ingredients, and in equal proportions it remains liquid at the lowest temperature.

Preparation.—The phosphorus and sulphur, in whatever proportions they are employed, are introduced into a flask or retort which is filled with pure water, heat is slowly and very cautiously applied, and when the phosphorus melts the combination takes place; but if the temperature be raised, the danger of explosion is considerable, from the decomposition of the water, the hydrogen of which, combining with sulphur and phosphorus, forms sulphuretted and phosphuretted hydrogen gases.

Properties.—The sulphuret of phosphorus is of a yellowish white colour, and somewhat crystallized in its appearance; it is not only liquid at a lower temperature than either of the constituent parts, but it is also more combustible; and this combustibility is increased by allowing the compound to burn for a little, and then, by excluding the air, to extinguish it. In this state it takes fire spontaneously in the open air, or by taking a little of it from a close vessel on the end of a match. Eight parts of phosphorus and one of sulphur remain liquid at 95°; one part of phosphorus and three of sulphur at 99°; but equal parts remain liquid when the temperature is reduced to 41°.

Chap. IX. Of Acids.

The acids constitute a very important class of bodies, not only in the changes which are going on in nature, and in the processes of art, but also as chemical agents. It is necessary, therefore, to be early acquainted with their nature and properties.

The substances which have been treated of in the five preceding chapters, enter into combination with oxygen in different proportions, with the exception of hydrogen, which combines only in one proportion, and the compound obtained is water. The first portion of oxygen which unites with the other substances forms compounds, which are distinguished by the name of oxides, because they are destitute of acid properties; but when a larger proportion of oxygen enters into the combination, new properties are acquired, which place them in the class of acids.

Characters.—This class of bodies is distinguished by a peculiar taste, which is familiar under the name of acid or sour; they redden vegetable blues; they combine readily with water, and enter into chemical union with alkalies, earths, and metallic oxides, and form compounds called *salts*.

Tests of acids.—Vegetable blue colours which are converted into red by the action of acids, are employed as tests to discover their presence. The infusion of red cabbage is most commonly applied to this purpose. It is prepared by dividing the thinner part of the leaves into shreds, and having poured on boiling water, let it stand for a few hours; or it may be prepared more speedily by boiling the cabbage for a short time. The infusion of the purple violet, or of mallow flowers, is prepared in the same way. Blue infusions of the same kind may be obtained from other flowers, and one of the most beautiful may be extracted from the dark purple columbine. Unsized paper stained with violets, mallows, or the raddish-root, answers the same purpose. The infusion or tincture of litmus, is the most proper test for carbonic acid. A single drop of the stronger acids will change a large quantity of the infusion to a fine red colour.

Names.—The *base* of an acid is the substance which combines with the oxygen, and acquires new properties. Sulphur is the base of sulphuric acid, and phosphorus is the base of phosphoric acid. But as oxygen combines in different proportions with these bases, the acid products have very different characters, and are therefore distinguished by different names. When the oxygen exists in the acid in the smaller proportion, the termination of the name is in the syllable *ous*, and when in the larger proportion it terminates in *ic*; thus *phosphorous* acid and *sulphurous* acid indicate the smaller proportion of oxygen; and *phosphoric* acid and *sulphuric* acid are expressive of the larger proportion of oxygen in the compound. While the acids form compounds with the alkalies, earths, or metallic oxides, the termination of the name of the salt is characteristic of the acid which enters into its composition. *Sulphite* or *phosphite* of soda denotes the compound to be derived from sulphurous or phosphorous acid; and *sulphate* or *phosphate* of soda, shews that sulphuric or phosphoric acid forms part of the combination. When the acids have been sometimes divided into mineral, vegetable, and animal, according to the sources from which they are derived, an arrangement has also sometimes been adopted of dividing them into such as have one, and such as have two bases. Most of the vegetable acids, as will appear afterwards, have a double base of carbone and hydrogen; but without pursuing any formal arrangement, which is generally connected with some theoretical views, the principal characters of the more important acids, with the method of procuring them, shall be detailed in the present chapter.

Sect. I. *Sulphuric Acid.*

Sulphuric acid, which is a compound of sulphur and oxygen, when the oxygen unites with the sulphur in the larger portion, seems to have been first noticed about the end of the 15th century, but was not particularly described till after the middle of the 16th century. It was formerly denominated vitriolic acid, because it was obtained from the metallic compounds called vitriols, and particularly, as at the present day, in some places from green vitriol or sulphate of iron; and, from its sluggish appearance when concentrated, was long known by the name of *oil of vitriol*.

Preparation.—If flowers of sulphur in a state of inflammation be introduced into a jar of oxygen gas, a splendid combustion, with the copious evolution of white fumes, takes place; and these fumes being condensed by a little water in the bottom of the jar, the water is found to possess acid properties.

The manufacture of sulphuric acid in the large way, is conducted by burning, in close leaden chambers, seven parts of sulphur with one part of nitre. In this process the sulphur, combining with a portion of oxygen, is converted into sulphurous acid gas; nitrous gas appears from the decomposition of the nitre, and combining with oxygen, becomes nitrous acid gas; the two gases unite, form a white crystalline solid, and being absorbed by the water at the bottom of the chamber, undergo another change. The sulphurous acid robs the nitrous acid of its oxygen, and is converted into sulphuric acid; while the nitrous gas, resuming its elastic form, separates from the water. This process is continued, till the water at the bottom of the chamber has become strongly acid. It is afterwards concentrated by evaporation in leaden vessels, and to render it still stronger it is distilled in glass vessels. This distillation is also necessary to separate some combinations of lead and potash, which are formed during the process.

Properties.—When the fuming acid, as it is prepared in some places of Germany, is distilled in glass vessels with a moderate heat, the fuming portion may be collected separately in a receiver cooled with ice; and it appears in the solid form, resembling silky filaments, with some degree of tenacity. It fumes strongly in the air, and is gradually dissipated in vapour, but continues solid till the temperature reach 60°.

In its ordinary state of purification, sulphuric acid is a transparent, colourless liquid, of an oily consistence, without smell, but having a strong acid taste; reddens vegetable blues, and acts powerfully on animal and vegetable matters. The specific gravity, when as much as possible concentrated, is double that of water; but it rarely exceeds 1.84. The boiling point of sulphuric acid varies with the proportion of water; when the specific gravity is 1.850, it requires a temperature of 620°; and when it is reduced to the specific gravity of 1.0, it boils at 218°. Sulphuric acid of the specific gravity of 1.780 freezes at 45°, and continues solid at the temperature of 48°. It crystallizes in flat six-sided prisms, terminating in a six-sided pyramid; but it has the singular property of freezing most readily at a certain specific gravity, and if it be either more or less concentrated, it requires a greater diminution of temperature. Sulphuric acid has a strong attraction for water; and as a condensation takes place between the two liquids, heat is evolved during the combination; when the solid acid is dropt into water, the combination and condensation are so rapid as to produce an effect similar to that of red hot iron, by the sudden formation and extrication of the vapour of the water. If strong sulphuric acid be exposed to the air, it will attract in a few days more than six times its own weight of water. If one part of ice, and four parts of concentrated sulphuric acid, be mixed together, the ice instantaneously melts, and the temperature rises to 212°; but if the same proportions of acid and water be suddenly mixed together, the temperature of the mixture approaches to 300°.

The composition of sulphuric acid is stated, according to the analysis of Lavoisier, to be 71 of sulphur and 29 of oxygen in the 100 parts; but according to the analysis of Mr Chenevix, the proportions are 61.5 of sulphur, and 38.5 of oxygen.

If hydrogen gas and sulphuric acid be brought into contact, no action takes place in the cold; but being passed through a red hot porcelain tube, the acid is decomposed, water formed, and sulphur precipitated; and if the hydrogen gas be in large proportion, the sulphur is dissolved, and is disengaged in the form of sulphuretted hydrogen gas. Charcoal, at the boiling temperature, deprives sulphuric acid of a portion of its oxygen, and converts it into sulphurous acid, and carbonic acid is also formed; phosphorus, with the assistance of heat, also decomposes sulphuric acid—and the products are phosphoric acid and sulphurous acid; and sulphur being boiled with sulphuric acid, converts the whole into sulphurous acid.

The compounds of sulphuric acid with alkalies, earths, and metallic oxides, are known in modern chemical language by the name of *sulphates*.

Sulphuric acid is very extensively employed in many arts and manufactures; it is also used in medicine and pharmacy; and hence the preparation of this acid has been long an object of great importance.

Sect. II. *Sulphurous Acid.*

Sulphurous acid contains oxygen combined in its smaller proportion with sulphur; it was formerly called spirit of sulphur, and volatile sulphurous acid, from its peculiar properties.

Preparation.—The fumes of sulphur burnt in the open air consist of sulphurous acid; but it is more conveniently prepared by heating one part of mercury, and two parts of concentrated sulphuric acid, in a glass retort; a gas is disengaged, which should be collected in jars over mercury. This is sulphurous acid gas. In this process, part of the oxygen of the sulphuric acid combines with the mercury, and the sulphurous acid is separated.

Properties.—In the state of gas it has the physical properties of common air, has a pungent smell, is unfit for respiration, or for the support of combustion, reddens vegetable blues, and then destroys them; and 100 cubic inches weigh nearly 63 grains.

When strongly heated in a porcelain tube, sulphur is deposited. When the temperature is diminished by a freezing mixture to 31° below *zero*, the gas becomes liquid. If sulphurous acid gas and oxygen gas be passed through a red hot tube, they are converted into sulphuric acid; and when hydrogen gas and sulphurous acid gas are treated in the same way, the oxygen combines with the hydrogen, and forms water, and sulphur is deposited. If charcoal and sulphurous acid gas be exposed to a red heat, carbonic acid is formed, and the sulphur is set free. Phosphuretted hydrogen gas is decomposed by sulphurous acid gas; the hydrogen of the one combines with the oxygen of the other, and forms water, while the sulphur and phosphorus are deposited in the solid state. When sulphuretted hydrogen gas comes in contact with sulphurous acid gas, an instantaneous condensation is effected, water is formed, and solid sulphur is deposited, with the evolution of a great deal of heat. Water has a strong attraction for this gas. A bit of ice brought in contact with it is immediately melted. Water at the temperature of 40° is said by some to absorb the third of its weight of the gas; but, according to others, the proportion is not more than one-twelfth at the temperature of 60°. This water freezes at a few degrees below 32, without parting with any of its acid. Liquid sulphurous acid has the taste, smell, and other properties of the gas, and particularly that of destroying vegetable colours. Exposed to the atmosphere, it absorbs oxygen, and is converted into sulphuric acid.

Sulphuric acid separates sulphurous acid in the gaseous form from water and its other combinations. Concentrated sulphuric acid absorbs sulphurous acid gas, becomes of a brown colour,, and acquires a pungent odour; the fumes first given off by the action of heat crystallize in needle-shaped prisms. This substance was formerly called glacial sulphuric acid.

Sulphurous acid is much employed in the arts, and particularly in the bleaching of silk and woollen stuffs; it removes the stains arising from vegetable juices, and spots of iron from linen. By the analysis of some chemists, the proportion of the constituents in 100 parts are 85 of sulphur, and 15 of oxygen; but according to others, the proportion of sulphur is 68, and of oxygen 32°: the saline compounds with sulphurous acid are called *sulphites*.

Sect. III. *Nitric Acid.*

This acid, the constituent parts of which are now ascertained to be azote and oxygen, was known to the alchemists before the middle of the 13th century; and the process for preparing it is described by Basil Valentine, who lived in the 15th century. He distinguished it by the name of *water of nitre*; and before it received its present appellation, it was successively denominated *spirit of nitre*, and *aqua fortis*. Nitric acid exists in great abundance in nature; its constituent parts are evolved during the putrefactive process of animal and vegetable matters, but it is always in combination with some base.

Preparation.—If three parts of nitre or saltpetre, with one of sulphuric acid, be mixed together in a glass retort, to which a glass receiver is secured, by luting or grinding, and a strong heat applied to the retort, a gas is given out during the process, which, being condensed in the receiver by the application of wet cloths, is nitric acid. The nature of this process will be easily understood by considering that nitre is composed of nitric acid and potash, and that sulphuric acid, having a stronger affinity for the potash, combines with it, and the nitric acid of the nitre being set free is expelled by the heat, and condensed into the liquid form when it enters the cooled receiver. To purify the acid thus obtained, it is distilled, with the addition of some substances, as nitrate of silver, to separate the muriatic acid, and nitrate of barytes to separate the sulphuric acid, with which it is usually contaminated. The acid is still of a reddish colour, from the fumes of nitrous gas, but these fumes may be separated by the application of a gentle heat.

Properties.—Thus prepared and purified, nitric acid is transparent and colourless, has a strong acid taste, a pungent odour, is very corrosive, and communicates to the skin a yellow stain. The specific gravity of the strongest acid is stated at 1.62, but it rarely exceeds 1.554. It has a very strong affinity for water, and is never entirely deprived of that liquid; it readily attracts moisture from the air, and when water is added heat is evolved in consequence of the condensation of the mixture.

When nitric acid is exposed to the light it is partially decomposed, nitrous gas is formed, which, mixing with the acid, communicates an orange yellow colour. The boiling point of nitric acid varies according to the proportion of water which it contains. With a specific gravity of 1.42, it requires a temperature of 248°, but when the specific gravity is either greater or less it boils at a lower temperature. When it is passed through a red hot tube it is converted into its constituent parts, oxygen and azotic gases; and when it is cooled down to 66° below *zero*, it crystallizes in a few minutes, assumes a deep red colour, and by agitation congeals into a thick mass like butter.

Nitric acid, when passed through a red hot tube with hydrogen gas, is decomposed, the hydrogen and oxygen form water, and the azotic gas is set free. Nitric acid and charcoal, exposed to a high temperature, afford carbonic acid and azotic gas; the carbone unites with the oxygen, and azotic gas is expelled. A similar decomposition is effected by phosphorus and sulphur; at a high temperature each of these bodies unites with the oxygen of the acid, and forms phosphoric or sulphuric acids, while the azotic gas, the other constituent of nitric acid, is set free.

The mixture of nitric and sulphuric acids produces heat; for the sulphuric acid attracts the water from the nitric acid, which latter becomes more concentrated, but nitric acid separates sulphurous acid from water and its other combinations, gives out its oxygen, and converts it into sulphuric acid, and passes itself into the state of nitrous gas.

The constituent parts of pure nitric acid are 74 parts of oxygen and 26 parts of azote in 100 parts; the saline compounds of nitric acid are denominated *nitrates*; and it is one of the most important of the acids, whether it be considered as a powerful agent in the hands of the chemist, or as it is employed in the arts, and in medicine.

Exper. 1.—If atmospheric air be gradually admitted into a jar of pure nitrous gas, which is transparent and colourless, reddish fumes make their appearance after every addition of the air, and a condensation takes place in consequence of the aeriform substances being converted into the liquid state, which, combining with the water over which the experiment is performed, the latter rises in the inside of the jar. The liquid thus formed is nitric acid, and the gas remaining is the azotic gas of the atmosphere.

Exper. 2.—If oxygen gas be substituted for atmospheric air, the condensation will be complete; the whole will be converted into nitric acid, and the water will rise to the top of the jar.

Exper. 3.—If the electric spark be passed through common air in a glass tube, the air is diminished in bulk, and nitric acid is formed; and if oxygen and azotic gases be mixed in certain proportions, the whole is converted into nitric acid.

Exper. 4.—Take a glass tube, of about one-sixth of an inch in diameter, close it at one end with a cork, through which a metallic conductor with a ball at each extremity passes, and having filled the tube with mercury, immerse the open end into the mercurial trough, and introduce a mixture of 13 parts of azotic gas, and 87 parts of oxygen gas, occupying 3 inches of the tube, and a solution of potash filling half an inch more. Let electrical explosions be directed through the tube till the air ceases be diminished in bulk. If the ingredients employed be in proper proportion, the potash will be converted into nitre.

These experiments, which were made by Mr Cavendish, afford the most satisfactory evidence of the constitution of nitric acid.

Sect. IV. *Nitrous Acid.*

Nitrous acid, in common language, is a mixture of nitric acid and nitrous gas; but, according to the present chemical nomenclature, it ought to bear the same relation to nitric acid that sulphurous acid bears to sulphuric, that is, it should be a compound of azote and oxygen, having acid properties; but with a smaller proportion of oxygen than what exists in nitric acid. Such an acid can be obtained in a separate state.

Preparation.—If a quantity of dry nitrate of lead be distilled in a glass retort, an orange-coloured liquid is obtained; this liquid is considered to be nitrous acid nearly in a state of purity.

Properties.—The taste of this liquid is strongly acid; it is extremely volatile, and rises in thick fumes. It boils at the low temperature of 82°, and the specific gravity is 1.45. In the state of vapour, nitrous acid remains unchanged by the action of heat; but when nitrous acid is mixed with water, an effervescence takes place, with the evolution of nitrous gas, from which it appears that some change in its constitution is effected, and that it is converted into what is commonly known by the name of nitrous acid.

The saline compounds of nitrous acid are denominated *nitrites*; but these salts are rarely produced by direct combination. If, for example, nitre be exposed to strong heat, a great deal of oxygen gas is given out, which must proceed from the decomposition of the acid; a neutral salt still remains behind, having different properties from those of common nitre. This salt is considered to be a compound of nitrous acid and potash, or nitrite of potash.

As nitric acid combines in different proportions with nitrous gas, it affords many varieties of the nitrous acid, or *aquafortis* of commerce and the arts; and, according to the quantity of nitrous gas absorbed, the acid exhibits very different colours, as yellow, orange, olive, and green. These colours also vary with the proportion of water combined with the acid.

Sect. V. *Muriatic Acid.*

Till the late discoveries of Sir Humphry Davy the constituent parts of muriatic acid were unknown. According to his views it is a compound of hydrogen and chlorine, in which the latter acts the part of an acidifying substance. Of the nature of this substance some account will be given in the next section; in the meantime the properties of muriatic acid may be examined without reference to its composition. The name is derived from the Latin word *muria*, which signifies sea-salt, or common salt, from which the acid is usually obtained, and it has been sometimes distinguished by the names of marine acid, acid or spirit of salt.

Preparation.—Muriatic acid may be obtained by introducing equal parts of common salt and sulphuric acid into a retort; and if the retort communicate with a receiver, in the bottom of which there is a quantity of water to condense the vapour as it passes over, liquid muriatic acid is obtained. But to collect the acid in the state of gas it must be received in jars, inverted over mercury. When it first passes over it is in the form of white fumes, but becomes at last transparent.

Properties.—Muriatic acid gas possesses the physical properties of atmospheric air; the smell is pungent, and disagreeable, and the taste strongly acid; it reddens dry litmus paper, and other vegetable blues; smokes when it is diffused in the atmosphere, by mixing with the aqueous vapour; and 100 cubic inches, at the temperature of 60°, and the pressure of 30 inches, weigh nearly 40 grains. It is rapidly absorbed by water, which, at the temperature of 40°, combines with 480 times its bulk of the gas. When water is saturated with the gas, it is then called liquid muriatic acid. With this quantity of gas the specific gravity of the solution is 1.21. The gas is unfit for respiration or the support of combustion.

Liquid muriatic acid, in its ordinary state, is of a pale yellow colour; but when it is purified by distillation it becomes transparent and colourless. Light has no action on muriatic acid, either in the state of gas or liquid, nor is it affected by oxygen, hydrogen, charcoal, phosphorus, or sulphur. Sulphuric acid separates muriatic acid from its compounds, and even from its combination with water, but muriatic acid expells sulphurous acid from that liquid. Muriatic acid and nitric acid, when mixed together, effervesce, give out heat, and produce a change of colour to an orange red. The compound, called nitro-muriatic acid, was formerly known by the name of *aqua regia*, from its property of dissolving gold, the *king of the metals*, in the language of the alchemists.

The saline compounds which are formed with muriatic acid are distinguished by the name of *muriates*.

Exper. 1.—Fill a jar over mercury with muriatic acid gas, and introduce a little water into the jar, the whole of the gas will be instantaneously absorbed, and the mercury will rise to the top of the jar, thus shewing the strong attraction between the gas and the water.

Exper. 2.—Let a jar be filled with muriatic gas over mercury, and let it be removed into a vessel of water coloured with vegetable blue, as soon as the water comes in contact with the gas it fills the jar, and becomes of a fine red colour. In this experiment the acid properties of the gas, and its rapid absorption by water, are illustrated at the same time.

Sect. VI. *Oxymuriatic Acid, or Chlorine.*

The discovery of oxymuriatic acid, in 1774, is recorded among the labours of the illustrious Scheele; he called it dephlogisticated muriatic acid, because he supposed that it is muriatic acid deprived of its phlogiston. About ten years afterwards it was particularly examined by Berthollet, and, according to his views, it was considered as muriatic acid combined with oxygen, and on that account it was denominated oxymuriatic acid. The French chemists, Gay-Lussac, and Thenard, about the year 1809, threw out a hint that oxymuriatic acid contains no oxygen in its composition; the same fact was asserted about the same time, or soon after, by Sir Humphry Davy; and in 1811, as the result of farther experiments, he concluded that it is a simple undecompounded substance, and from its greenish yellow colour he gave it the name of *chlorine*.

The nature and constitution of oxymuriatic acid are still the subject of controversy. The number, indeed, of those who unequivocally maintain the old doctrine is very small, and but few, we believe, have any hesitation in adopting the views of Scheele and Sir Humphry Davy. But whatever opinion be held, the description of the method of procuring it, and of its habitudes, must necessarily be the same.

Preparation.—Three parts of common salt by weight, one part of manganese in fine powder, and two parts of sulphuric acid, diluted with an equal quantity of water, being mixed together in a retort, and a moderate heat being applied, chlorine, or oxymuriatic acid gas, is evolved, and may be collected in jars over water. It may be obtained also by using the black oxide of manganese and liquid muriatic acid.

The nature of this process will be easily understood, according to the principles of the old doctrine, by recollecting that muriatic acid is assumed to be a compound of an unknown base with oxygen, and when it is expelled from the common salt by the superior affinity of the sulphuric acid for the soda, it unites with another portion of oxygen, derived from the manganese, and appears in a gaseous form. By the second process alluded to, the muriatic acid combines with part of the oxygen of the manganese, and is also expelled in the state of elastic fluid. But, considering chlorine as a simple substance, the process is thus explained: Muriatic acid is considered as a compound of hydrogen as its base, and chlorine as the acidifying substance, and in the above process the hydrogen of the acid combines with the oxygen from the metal, and forms water, while the chlorine is set free.

Properties.—Chlorine possesses the physical properties of common air; the colour is yellowish-green, the odour extremely disagreeable; it is unfit for respiration; and the weight of 100 cubic inches at mean temperature and pressure, exceeds 76 grains. Water, at the temperature of 60°, absorbs double its bulk of the gas, and acquires a strong astringent taste, a disagreeable smell, and a yellowish green colour.

This gas remains unchanged by heat or cold; but the aqueous solution freezes at the temperature of 40°.

Chlorine combines with oxygen, and the compound has acid properties; with hydrogen it forms muriatic acid; phosphorus when introduced into the gas is spontaneously inflamed; sulphur, when melted or sublimed in it, does not burn, but is converted into a volatile red liquor; an inflamed taper immersed in it gives out a dull red flame, with black thick smoke; and metallic substances, in a finely divided state, take fire in the gas, and burn spontaneously at the ordinary temperature of the air.

The compounds of chlorine with combustible substances are distinguished by the name of *chlorides*.

The most important property of chlorine is that of destroying vegetable colours, on account of which it is extensively employed in bleaching, and, by abridging the processes, has given a degree of certainty to that art, of which, till this fortunate application was made, it seemed unsusceptible.

Oxides.—Chlorine combines with oxygen in different proportions; one of these compounds is obtained by introducing a quantity of hyper-oxymuriate of potash into a small glass retort, and pouring over it as much muriatic acid, diluted with its bulk of water, as will cover it; with a gentle heat a gas is evolved, which should be collected over mercury. The constitution of this gas was discovered in 1811 by Sir Humphry Davy, who, from its bright yellow-green colour, gave it the name of *Euchlorine*. The smell has some resemblance to that of burned sugar; it is unfit for respiration, is absorbed by water, which takes up eight or ten times its own bulk, and becomes of a lemon-yellow colour; and 100 cubic inches exceed 74 grains in weight. The constituent parts of this gas are about 82 of chlorine and 18 of oxygen in the 100 parts.

This oxide of chlorine explodes with a very moderate heat, and its elements separate from each other with great violence, and with the evolution of light. Phosphorus introduced into the gas takes fire, and produces its decomposition with an explosion. This gas destroys vegetable colours; but first communicates to blues a tint of red.

Another oxide of chlorine, in which the oxygen is in larger proportion, has been examined. It is prepared by mixing together a very small quantity of hyper-oxymuriate of potash; the quantity of the salt ought not to exceed 40 or 50 grains, reduced to powder, and mixed with sulphuric acid till the whole is brought to the state of a dry paste. This paste is put into a small glass retort, which is to be immersed in hot water, but always kept under the temperature of the boiling point. A bright yellowish-green gas is soon given out, which is to be collected in jars in the mercurial apparatus.

This gas is of a brighter yellowish-green than the former, water absorbs nearly the same quantity, and becomes of a deep yellow colour. Without previously reddening vegetable blues, it destroys them in the moist state. It explodes when raised to the temperature of boiling water; phosphorus introduced into it produces an explosion followed by a splendid combustion; and 100 parts are composed of 53 of chlorine and 47 of oxygen.

Chloric acid.—Oxygen enters into combination in still larger proportion with chlorine, and the compound possesses acid properties. It is prepared by dissolving hyper-oxymuriate of barytes in water, and adding slowly and cautiously diluted sulphuric acid while any precipitate is formed. In this way, if the sulphuric acid be not added in excess, chloric acid is obtained in solution in water.

Properties.—The solution in water is colourless; it has no perceptible smell; with a moderate heat it may be concentrated, when it assumes the consistence of an oil; when the temperature is raised, it is partly volatilized without change, and partly decomposed into its constituents, chlorine and oxygen; 100 parts are composed of about 47 chlorine and 53 oxygen; and the saline compounds of this acid are denominated *chlorates*. According to the views of Berthollet this acid is called hyper-oxymuriatic acid.

Sect. VII. *Chloriodic Acid.*

It is a curious circumstance, and must be regarded as a singular anomaly in chemical combinations formerly known, that some of the substances which later discoveries have brought to light, perform in one case the part of a base, and in another that of the acidifying constituent. Chlorine itself, and iodine, with which it forms an acid, seem to possess this double property; but before detailing the character and habitudes of the acid, it is necessary to notice the discovery, and trace the history of iodine.

Iodine.—Iodine was discovered in 1811, by Courtois, a chemical manufacturer at Paris; but it was not till the end of 1813 that it was announced to the Institute of France. It was afterwards examined both by the French and British chemists.

Preparation.—A quantity of the kelp of commerce being reduced to powder, is dissolved in water; the solution is filtered and evaporated till the whole of the crystals of common salt are separated. The remaining liquid being mixed with sulphuric acid, is boiled for some time; and during this process muriatic acid and sulphuretted hydrogen gas are expelled. After boiling, the liquid is introduced into a small matrass or retort, and a quantity of black oxide of manganese, equal in weight to the sulphuric acid employed, is mixed with it; and with the application of heat a vapour of a violet colour is expelled and condensed in the form of a black shining substance on the sides of the receiver with which the retort communicates. The matter thus obtained is *iodine*.

Properties.—Iodine is in the form of scales, and sometimes crystallized; the odour is disagreeable, the taste acrid; it stains the skin of a yellow colour, and, like chlorine, destroys vegetable colours, but in an inferior degree. Iodine is fused at the temperature of 224°, and at 350° rises in vapour, which is of a deep violet colour, and from which the name is derived. Water dissolves a very small proportion, but acquires a peculiar smell, and becomes of an orange-yellow colour.

Iodine unites with oxygen, and the compound, which has acid properties, is white, semi-transparent, and solid, destitute of smell, but with a strong acid taste. When heated it melts, and when the temperature is raised separates into its constituent parts; deliquesces in the air, is very soluble in water, and the solution first reddens, and then destroys vegetable blues.

If a current of chlorine gas be passed into a vessel containing iodine, a combination takes place; and when the iodine is saturated, chloriodic acid is formed. This compound, the acid nature of which is not fully ascertained, is very volatile, deliquesces in the air, is soluble in water, and destroys vegetable blues.

From the chemical history of chlorine and iodine, a brief abstract of which has now been given, it would appear that these two remarkable substances possess some analagous properties, however distinct they are in others; but after all the researches which have been employed in tracing their nature and habitudes, experiments are perhaps still wanting finally to determine their true character.

Sect. VIII. *Fluoric Acid.*

Fluoric acid is so called because it is obtained from fluor spar, a well known mineral production in some of the mining districts in England, and long employed as a flux for metallic ores. Its remarkable property of corroding glass, when decomposed by sulphuric acid, was observed soon after the middle of the 17th century; and after various attempts by other chemists, the composition of fluor spar was ascertained by the experiments of Scheele, and found to be lime and a peculiar acid, which he distinguished by the name of *fluoric acid*.

Preparation.—Fluor, or Derbyshire spar, is reduced to fine powder, and is introduced into a retort of silver or lead, with twice its weight of concentrated sulphuric acid, and the retort being connected with a receiver of the same metal, cooled with a mixture of snow and salt, heat is applied to the retort, and the acid is driven off and deposited in the receiver in the liquid form.

Properties.—Liquid fluoric acid is transparent and colourless when it is kept at the temperature of the freezing point of water. It remains liquid at the temperature of 60°, but in the open air gives out copious suffocating fumes, and is soon dissipated. The gas is unfit for respiration and for the support of combustion. The liquid acid dropt into water produces a hissing noise, with the evolution of heat; when it touches the skin it corrodes it, and leaves a painful wound; and it reddens vegetable blues.

The singular property of corroding glass is one of the most remarkable characters of fluoric acid. When distilled in glass vessels, the acid combines with the siliceous earth of the glass, and appears in the form of elastic fluid, which, from its composition, is called silicated fluoric gas, of which 100 cubic inches weigh nearly 111 grains. When this gas is brought into contact with water it deposits a white gelatinous substance, which is hydrate of silica, or a compound of water and the earth, and the water becomes an acid solution.

The saline compounds of fluoric acid are denominated *fluates*.

Constituent parts.—The discovery of the composition of muriatic acid, and the comparison of fluoric and muriatic acids, which possess some analagous properties, have led to speculations of their constitution being somewhat similar. According to these views, fluoric acid is supposed to be a compound of hydrogen, and an unknown base, which has been called *fluorine*. But the existence of this base is only inferred from certain changes which are induced when those compounds of which fluoric acid forms a part are subjected to the operation of certain agents. In no experiment yet attempted has it been obtained in a separate state. Hydrogen, one of the supposed constituents, whatever be its origin, always appears; but the supposed fluorine is always in combination with some of the substances employed in the process. When, for example, fluoric acid is subjected to galvanism, hydrogen gas is given out at the negative end of the battery; and if wires of platina be used, the positive wire is coated with a substance of a chocolate appearance, which is supposed to be a compound of fluorine and the metal. Muriatic acid being exposed to the same action, undergoes decomposition, and also affords hydrogen from the negative wire, while the chlorine combines with the positive wire.

As the compounds of chlorine with those substances which have not acid properties are denominated *chlorides*, according to the same analogy the compounds of fluorine are called *fluorides*. The compounds of fluoric acid, and the alkalies and earths known by the name of fluates in the former views of their constitution, are to be considered, according to the new doctrine, as compounds of fluorine and the metallic base of those alkalies and earths which are to be noticed afterwards in detailing the chemical history of those bodies.

Sect. IX. *Boracic Acid.*

Boracic acid is one of the constituents of *borax*, a substance which has been long known in medicine and the arts, was separated from it by Homberg about the commencement of the 18th century, by distillation, and from him received the name of *narcotic* or *sedative salt*.

Preparation.—A quantity of borax of the shops, which is a compound of this acid and soda, is dissolved in hot water and filtered; sulphuric acid is gradually added till the liquid acquires a slight degree of acidity; and as the solution cools, the boracic acid is precipitated in shining scales. In this process the sulphuric acid unites with the soda, and sets free the boracic acid. The solid boracic acid is purified by washing with cold water, which carries off any adhering soluble salts.

Properties.—Thus obtained, boracic acid is in the form of silvery white six-sided scales, which have a greasy feel, a sourish taste, which afterwards gives the sensation of coolness, have no smell, and redden vegetable blues.

Boracic, when exposed to heat, froths up, owing to the separation of the water of crystallization, becomes a viscid paste, and is known by the name of calcined borax; subjected to a red heat it is converted into a hard transparent glass, which, without attracting moisture from the air, becomes opaque, but is otherwise unchanged; and, when re-dissolved in warm water, recovers, by cooling and crystallization, all its former properties.

Boracic acid is not very soluble in water, the solution has little taste, but it reddens the tincture of turnsole, and paper moistened with the solution burns with a green flame. The acid rises with the vapour of water when it is distilled in close vessels, and crystallizes in the receiver.

The saline compounds of boracic acid are called *borates*. It is employed in the arts, as in soldering, to assist the fusion of metallic substances, and it is of much importance to the mineralogist in promoting fusion by the blow-pipe.

Borone.—The base of boracic acid, which was long unknown, is supposed to be a substance in some measure analogous to carbone. If a quantity of boracic acid be fused and reduced to powder, and mixed with potassium, the metallic base of potash, and the mixture being in equal proportions introduced into an iron tube, which is to be gradually heated till it becomes slightly red, the acid is decomposed; and when the tube is cold the matter is to be washed out with water, and the potash formed being neutralized with muriatic acid, and the solution filtered, borone remains behind on the filter. It may be obtained also by subjecting the acid, slightly moistened, to the action of a galvanic battery; a dark coloured substance, which is borone, separates at the negative end of the battery.

Properties.—Borone is an opaque, olive-coloured powder, infusible, and is not volatile at a very high temperature. When it is strongly heated in contact with air, it undergoes combustion, and forms dry boracic acid. In oxygen gas it throws off bright sparks, and is coated with boracic acid; it burns with a white flame in chlorine gas, and a white substance lines the vessel, which is supposed to be the *chloride* of borone. By mixing together in a retort one part of fused boracic acid, with two parts of fluor spar, and 12 parts of sulphuric acid, a gas is obtained by the application of heat, which is found to possess acid properties. This gas, which must be collected in the mercurial apparatus, is colourless, smells like muriatic acid, has a very acid taste, and reddens vegetable blues; 100 cubic inches exceed 72 grains in weight, and water absorbs 700 times its own bulk. It is called *fluoboric* acid.

Sect. X. *Phosphoric Acid.*

When phosphorus is subjected to combustion in oxygen gas, the white fumes that arise, and are deposited in the state of white flakes, are phosphoric acid; which is therefore considered to be a compound of phosphorus and oxygen.

Preparation.—Phosphoric acid may be obtained by the decomposition of bones, of which it forms a constituent part, according to the process which has been already described in the preparation of phosphorus. When liquid phosphoric acid is evaporated, the acid remains behind in the solid state, and the whole of the water may be driven off by subjecting it to a red heat; it is then called phosphoric glass, and is transparent, colourless, and solid. It attracts moisture from the air, becomes viscid, and is very soluble in water. In the state of white flakes it dissolves with a hissing noise; the taste is acid, and it reddens vegetable blues.

Phosphoric acid is decomposed by means of charcoal, when exposed to a red heat; the carbone combines with the oxygen of the acid, and the phosphorus is separated. Sulphuric acid attracts the water from phosphoric acid, and leaves the latter behind in the state of a transparent viscid matter, or in that of glass, if strong heat be applied. Sulphurous acid is separated from its combinations by phosphoric acid; but the latter is separated by nitric and muriatic acids.

The component parts of this acid, according to the analysis of Lavoisier, are 60 of oxygen and 40 of phosphorus; the salts formed with it are denominated *phosphates*, and it is of much importance in many chemical operations.

Sect. XI. *Phosphorous Acid.*

Phosphorous acid is supposed to stand in the same relation to phosphoric acid that sulphurous acid bears to sulphuric, and is combined with a smaller proportion of oxygen. When small pieces of phosphorus are exposed to the air in a glass funnel placed in a bottle, they attract oxygen and moisture from the atmosphere, become liquid, and run down into the bottle. The liquid thus obtained is three times the weight of the phosphorus employed, and was formerly supposed to be phosphorous acid. It is thick and white, has an acid pungent taste, and reddens vegetable blues. But, from some late experiments on the product of this process, it appears to be a compound of phosphoric and phosphorous acid in equal proportions.

By the process proposed by Sir Humphry Davy, pure phosphorous acid may be obtained when phosphorus is sublimed through corrosive sublimate in powder in a glass tube; a colourless liquid comes over, which being mixed with water and evaporated to the consistence of syrup, is found to be a compound of phosphorous acid and water, in the proportion of nearly 81 parts of the former and 19 of the latter.

When this solution cools it becomes solid; the taste is strongly acid; and it has the property of changing vegetable blues to red. When it is strongly heated in open vessels it is inflamed, a copious evolution of phosphuretted hydrogen gas takes place, and what remains in the vessel is converted into phosphoric acid. During this process it is obvious the water is decomposed, its hydrogen unites with a portion of phosphorus, which passes off in the form of phosphuretted hydrogen gas, and the oxygen, combining with another portion of phosphorus, converts it into phosphoric acid. The saline compounds of phosphorous acid are called *phosphites*.

Sect. XII. *Carbonic Acid.*

The numerous combinations, and the remarkable discoveries in chemical science, which accompanied or followed the investigations of the nature of this substance, render it one of the most important of the acids. It was regarded by the ancients, from its noxious effects, as a pestilential vapour; Dr Hales gave it the name of fixed air, because it entered into the composition of solid bodies; and Dr Black, in his experiments on lime, magnesia, and the alkalies, proved that it is a peculiar substance different from common air, and that these bodies being combined with it, are deprived of their causticity, and rendered mild. Its acid properties were detected by Keir and Bergman, who called it aerial acid, and it received various other names, as mephitic acid, calcareous or cretaceous acid, from its deleterious effects, or from the substances from which it is obtained. The nature and constitution of this acid were finally ascertained by Lavoisier, who, according to the improved chemical nomenclature, distinguished it by the name of carbonic acid, from its base, carbone.

Preparation.—If a piece of charcoal in a state of ignition be immersed in a jar of oxygen gas, it burns with great brilliancy; and when the combustion has ceased, the air in the vessel has undergone a complete change. This new product being agitated with a little water introduced into the jar, combines with it, and exhibits acid properties; it is carbonic acid; but this acid may be collected in great abundance by putting a quantity of chalk, or limestone, or marble in the state of coarse powder, into a retort or mattrass with a bent tube attached to it, and adding diluted sulphuric, or nitric, or muriatic acids; a violent effervescence takes place by the evolution of gas, which may be collected in jars over water. The nature of this process is easily understood; the calcareous matter employed is a compound of carbonic acid and lime, but the sulphuric or other acids alluded to having a stronger affinity for the lime than the carbonic acid, the latter is set free, and passes off in the form of elastic fluid.

Properties.—Carbonic acid in the state of gas possesses the physical properties of common air; it is totally unfit for respiration or for the support of combustion; it has a peculiar sharp taste, and a faint, but agreeable smell; 100 cubic inches at the temperature of 60°, and when the barometer stands at 30 inches, weigh about 47 grains; and it reddens the tincture of turnsole, which is the proper test of this acid.

Water, at the temperature of 41°, absorbs its own bulk of the gas; but by artificial pressure it combines with a larger proportion, and in this way aerated waters are prepared, which thus acquire an acidulous taste. The whole gas is expelled by boiling, and it is also separated when the temperature of the water is reduced to the freezing point.

Carbonic acid is composed of nearly 18 parts carbone and 82 parts of oxygen; and the compounds of this acid, with the alkalies, some of the earths and metallic oxides, are known by the name of *carbonates*.

Exper. 1.—Fill a jar with carbonic acid gas, and immerse a lighted taper in it; the moment it comes in contact with the surface of the gas it is extinguished. The same experiment may be repeated several times in the same gas.

Exper. 2.—Fill a jar with carbonic acid gas, and after removing it from the shelf of the pneumatic apparatus, hold it for a few minutes in the same inverted position, and it will be found, when it is examined with a lighted taper, that the whole of the gas has escaped, and the air of the atmosphere has taken its place.

Exper. 3.—Place a lighted taper at the bottom of a deep bason or a wide jar, and having filled another jar with carbonic acid gas, invert it at a little height above the taper, and it will be as effectually extinguished as if water were poured upon it.

Carbonic acid gas is a very abundant natural production; it is formed in the processes of combustion and respiration, and during the fermentation of vegetable matters; and being specifically heavier than common air, it collects at the bottom of pits and caverns, and hence small quadrupeds, when they enter such places, are instantly suffocated, because they respire only this deleterious air. A cavern in Italy has been long known as being fatal to dogs, and hence it is called the *Grotto del Cani;* while men who breathe the stratum of common air in the upper part of the cavern escape uninjured. Fatal accidents have frequently happened to persons who have descended into large vats in which the process of fermentation has been carried on, or into pits or wells which have been long shut up. A single inspiration of this noxious gas seems to produce instant death. Similar accidents have befallen those who respire the fumes of burning charcoal in close apartments. In such cases, if life be not entirely extinguished, the most successful method of recovery recommended, is to dash cold water on the head and body, a practice which is usually adopted in northern regions, where the general use of charcoal is often followed by such fatal effects.

Sect. XIII. *Of Metallic Acids.*

Metallic substances unite with oxygen in different proportions, and the compounds thus formed are denominated oxides; but some of the metals combine with oxygen in larger proportion, and exhibit acid properties. Compounds of this nature are obtained from arsenic, tungsten, molybdena, chromium, and columbium.

1. *Arsenic acid.*—Arsenic combines with oxygen in two proportions, the first, which is the common arsenic of the shops, or the white oxide of arsenic, is called *arsenious acid.* It is usually in the form of a solid white cake, has an acrid taste, and is highly poisonous; is not very soluble in cold water, but hot water takes up a large proportion; and it reddens vegetable blues. The compounds of the alkalies with this acid are denominated *arsenites.*

Arsenious acid is converted into arsenic acid by repeated distillation with nitric acid, or it may be obtained by dissolving metallic arsenic in nitric acid, and after evaporating the solution to dryness, again to dissolve the residuum in water, and filtering the solution to evaporate again to dryness.

Properties.—Arsenic acid thus obtained is in the form of a white solid mass, has a sour and somewhat metallic taste; reddens vegetable blues, attracts moisture from the air, and when exposed to strong heat in a retort or crucible it corrodes the vessel, remains transparent, and is converted into a glass. This acid is more soluble in water than the former. The compounds of arsenic acid, with the alkalies, earths, and metallic oxides, are known by the name of *arseniates*.

2. *Tungstic acid.*—Tungstic acid is found in nature in two mineral substances, in the one of which it is combined with lime, and in the other, called wolfram, with iron and manganese. If one part of tungstate of lime and four parts of carbonate of potash be fused together, the mass is soluble in 12 parts of boiling water. To this solution, add nitric acid, which unites with the potash and precipitates tungstic acid. It may be obtained also by fusing wolfram with twice its weight of carbonate of potash. The fused mass being dissolved in boiling water, and filtered, affords, with the addition of nitric acid, a precipitate of tungstic acid, which, after being washed and dried, is in the form of a yellow powder, without taste, insoluble in water, and effecting no change on vegetable blues. The compounds of tungstic acid with the alkalies, which are soluble, and with the earths and metallic oxides which are insoluble in water, are denominated *tungstates*.

3. *Molybdic acid.*—This acid is usually obtained from a mineral substance, which is a compound of sulphur and molybdena. If a portion of the mineral substance be reduced to powder, introduced into a retort with six times its weight of nitric acid, and distilled to dryness, and this process being repeated several times, both the sulphur and the metal combine with oxygen and become acid. The sulphuric acid is separated by heating the mass in a crucible, and afterwards washing it with pure water; and molybdic acid, which is in the form of a white powder, having an acid metallic taste, remains. It is not very soluble even in boiling water; the solution is of a pale yellow colour, has no taste, but reddens paper stained with litmus, and is precipitated by sulphuric, nitric, and muriatic acids. The compounds with alkaline, earthy, and metallic bases, are called *molybdates*.

4. *Chromic acid.*—This acid is found in nature in combination with lead or iron. It may be obtained by reducing the chromate of iron to powder, mixing two parts with one of nitre, and subjecting the whole in a crucible for several hours to a strong heat. Dissolve the mass in water; the insoluble portion that remains is a mixture of oxide of iron and of the chromate yet undecomposed; add muriatic acid to separate the oxide, and mix the chromate with a fresh portion of nitre, which is to be subjected a second time to a strong heat; saturate the solution of potash and chromic acid, and evaporate the solution till the chromate of potash crystallizes. This salt being dissolved in water, the chromic acid is precipitated by muriate of barytes. The chromate of barytes which falls down, being well washed with water, is to be dissolved in nitric acid, and the barytes being precipitated by means of sulphuric acid, the solution is to be filtered and evaporated to dryness with a moderate heat. To separate the whole of the nitric acid, the addition of the water and the evaporation require to be repeated several times. The dry mass is chromic acid.

Chromic acid is of a deep red colour, has an acid strongly metallic taste, deliquesces in the air, and is soluble in water, from which it may be obtained crystallized of a ruby colour. When it is heated, part of the oxygen is expelled, and it is converted into the green oxide. When it is mixed with muriatic acid the mixture acquires the property of dissolving gold. It combines readily with the alkalies, and communicates an orange colour to the crystals. From this property it has derived its name. The compounds are called *chromates*.

The metal called columbium, discovered by Mr Hatchet, also forms an acid, an account of which may be found in his memoir published in the *Phil. Trans.* for 1802.

Sect. XIV. *Acetic Acid.*

Acetic acid, which is produced in one stage of the fermentation of vegetable matters, was known, at least in an impure form, and under the name of *vinegar*, in the earliest ages of the world. When vinegar is distilled it is distinguished by the name of acetous acid; and when it is still farther purified from those substances with which it is contaminated, and concentrated by separating the water, it is radical vinegar, or acetic acid.

Vinegar, which is formed when vegetable infusions become sour, is of a reddish yellow colour, an agreeable smell, and pleasant acid taste; when it is distilled with the heat of boiling water, it becomes quite colourless and the taste is more strongly acid. This is distilled vinegar or acetous acid; and it may be still farther concentrated by exposing it to cold by which the water is frozen.

Acetic acid is prepared by the decomposition of some of those compounds of which it forms a part. If a quantity of acetate of copper be reduced to powder, and put into a retort and distilled, a colourless and nearly insipid liquid first comes over, and afterwards a very pungent acid. This acid requires a second distillation to purify it from a greenish tinge, arising from a portion of the copper; it is then transparent and colourless.

Acetic acid may be also obtained by the distillation of three parts of acetate of potash and four parts of sulphuric acid. The sulphuric acid combines with the potash and the acetic acid being set free passes over into the receiver, where it crystallizes. To purify it from any remains of sulphuric acid it is subjected to a second distillation with a mixture of acetate of barytes.

Properties.—Acetic acid, when pure, is perfectly colourless, has a fine aromatic odour when in the state of distilled vinegar; but it is less agreeable when more concentrated, as when it is of the specific gravity of 1.08. Acetic acid is very volatile, reddens vegetable blues, is pungent and acrid, and reddens and corrodes the skin.

The constituent parts of acetic acid, are hydrogen, carbone, and oxygen; it is decomposed by the action of sulphuric and nitric acids, and its saline compounds are called *acetates*.

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Acetic acid is of great importance on account of its extensive application, not only to numerous purposes of domestic economy, but also of the arts.

Sect. XV. *Benzoic Acid.*

This acid derives its name from *styrax benzoe*, a tree which is a native of Sumatra; the resinous matter obtained from this tree is called *benzoin*; and the acid substance prepared by sublimation was called flowers of benzoin.

Preparation.—The common method of preparing this acid, is to introduce a quantity of coarsely powdered benzoin into an earthen pot, and covering the pot with a cone of thick paper, to apply a moderate heat; the acid is sublimed and is deposited on the paper. But it may be obtained by digesting benzoin in sulphuric acid; and in this process the acid is purer, and in finer crystals.

Properties.—Benzoic acid is a fine white matter in the form of needles, which have some degree of ductility; the taste is acrid, pungent, and bitter; the odour when heated is aromatic; it has but a feeble effect on some vegetable blues; but, when it is hot, reddens the tincture of turnsole.

Exposed to a moderate heat, it melts and becomes soft and spongy; with a stronger heat it is sublimed and exhales a white acrid vapour; and when set fire to, burns without leaving any residuum. It undergoes no change in the air; is little soluble in cold water; but 25 parts of boiling water dissolve about one part of the acid. Benzoic acid is soluble in some of the stronger acids, but is separated from the solution by the addition of water; it consists of hydrogen, carbone, and oxygen; and the saline compounds are called *benzoates*.

Benzoic acid exists in some animal secretions, particularly those of the horse and cow, and is supposed to be derived from the grass or hay which forms part of their food. The peculiar odour of *anthoxanthum odoratum*, and *asperula odorata*, which are both known in common language under the name of sweet-scented grass, is owing to benzoic acid; and from the first of these plants hay derives its fine smell.

Sebacic acid—from the later researches of chemists, seems to be of the same nature as benzoic acid; it is prepared by distilling hog's lard or tallow, washing the product with hot water, and after separating the water by dropping into it a solution of sugar of lead, a flaky precipitate is obtained; which being collected and dried, and mixed with sulphuric acid, a melted substance like fat, when heat is applied, swims on the surface. This matter being separated and washed, is boiled with water in which the whole is dissolved; and when it cools, crystals in the shape of needles, which are sebacic acid, are deposited. It requires a higher temperature than benzoic acid to sublime it; but it approaches so nearly to the latter in its other properties, that it is supposed to be contaminated with some substance the nature of which is unknown.

Sect. XVI. *Succinic Acid.*

This acid derives its name from the Latin word which signifies *amber*, because it is obtained from that substance.

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Preparation.—Introduce into a retort a quantity of powdered amber, so that the body of the retort shall be half full; cover the amber with dry sand, apply a receiver which much be secured with a lute, and distil with a moderate sand heat. The first product is an insipid phlegm, which is succeeded by a portion of weak acetic acid; and, last of all, a substance is deposited in the neck of the retort, which is succinic acid. To separate the acid from some oil with which it is contaminated, it is dissolved in hot water, filtered through cotton, which should be previously moistened with oil of amber, and then crystallized by slow evaporation.

Properties.—The crystals of this acid are transparent, white, and shining, and of a prismatic form; the taste is acid, and they redden the tincture of turnsole.

Succinic acid requires a considerable heat for its sublimation; it is not very soluble in cold water; but two parts of boiling water are sufficient for its solution, from which, on cooling, the greater part crystallizes. It is soluble in sulphuric and nitric acids with the aid of heat; is not decomposed by muriatic acid, but assisted by heat forms a jelly.

The constituent parts of succinic acid are carbone, hydrogen, and oxygen; its saline compounds are denominated *succinates*, and it is of great importance in separating iron from its solutions.

Sect. XVII. *Moroxylic Acid.*

An exudation of a saline nature, in small grains of a a yellowish brown colour, was detected on the bark of the white mulberry tree; and being examined by Klaproth, was ascertained to be a compound of lime with a peculiar acid; and he gave it this name because it was obtained from the wood of the mulberry tree.

The acid is separated by dissolving the salt in water, and adding acetate of lead, and mixing the precipitate with sulphuric acid diluted with water, a sulphate of lead is formed, while the moroxylic acid is set free and remains in the solution. It may be obtained crystallized by evaporating the liquid, and is still farther purified by sublimation. It has somewhat the taste of succinic acid, remains unchanged when exposed to the air, and is soluble in water. This acid is composed of hydrogen, carbone, and oxygen, and its saline compounds are called *moroxylates*.

Sect. XVIII. *Camphoric Acid.*

Camphor, a well known substance, which is the production of *laurus camphora*, a native of the East Indies, affords this acid, and gives its name.

The acid is prepared by distilling in a retort, with a sand heat, one part of camphor and eight parts of nitric acid; the same process is repeated with fresh portions of the acid three times, and after the third distillation, when the apparatus cools, crystals of camphoric acid, about one-half of the camphor employed, are formed. These crystals being separated from the nitric acid, are washed and dried.

Properties.—The acid thus prepared is in the form of snow-white crystals, which effloresce in the air; the smell resembles saffron; the taste is slightly acid and bitter, and it reddens vegetable blues; it is not very soluble in cold water, but boiling water dissolves about a twelfth part of its weight. With a moderate heat it melts and sublimes, but when it is placed on burning coals it gives out thick aromatic fumes, and is totally dissipated; it is soluble in sulphuric and muriatic acids; in nitric acid when heated it becomes yellow, and is also dissolved. The constituent parts of camphoric acid are hydrogen, carbone, and oxygen, and its saline compounds are called *camphorates*.

Sect. XIX. *Oxalic Acid.*

Oxalic acid exists, ready formed, in *oxalis acetosella*, or wood-sorrel, and some other plants allied to it, and hence it derives its name. Being obtained from sugar, it was called saccharine acid, or the acid of sugar.

Preparation.—Put an ounce of white sugar into a retort with three ounces of nitric acid, apply heat till the liquor boils, and the whole of the nitrous gas is driven off; the liquid in the retort becomes of a reddish brown colour, and then an additional quantity of nitric acid may be added, and the boiling continued till the fumes cease; the liquid is then poured out into a shallow vessel, and when it cools crystals are formed, which being collected and dried on blotting paper, are to be dissolved in distilled water, and again evaporated and crystallized. By a similar process, oxalic acid may be obtained from other vegetables, and from some animal substances, as gum arabic, alcohol, and honey.

Properties.—Thus prepared, oxalic acid is white and transparent, in the form of four-sided prisms, with two-sided summits; has a strong sharp taste, and reddens vegetable blues; it is soluble in twice its weight of cold water, and in its own weight of boiling water; and by exposure to moist air it is not changed, but effloresces when the air is dry.

It is volatilized by heat, partly in a liquid and partly in a solid and crystalline form; and when the temperature is raised, it is partially decomposed. Oxalic acid is decomposed by sulphuric acid, with the aid of heat, and charcoal is deposited; by means of nitric acid at the boiling temperature, it is converted into water and carbonic acid. These changes lead to a knowledge of its constituent parts, which analysis points out to be 77 of oxygen, 13 of carbone, and 10 of hydrogen; the saline compounds are called *oxalates*.

Oxalic acid, from its strong affinity for lime, is one of the best tests of that substance, the minutest quantity of which it separates from all its other combinations.

Sect. XX. *Tartaric Acid.*

Tartaric acid derives its name from tartar, the substance from which it is extracted, and it was first procured in a separate state by the celebrated Scheele.

Preparation.—Tartar, or cream of tartar, is dissolved in water, and powdered chalk is added till effervescence ceases, and the liquid no longer reddens vegetable blues; a precipitate is formed in the state of white powder, which being separated by filtration is well washed, and a quantity of sulphuric acid, equal in weight to the chalk employed, is poured upon it and allowed to remain for a day or two, during which the mixture should be occasionally stirred; the liquid being afterwards filtered and evaporated, crystals of tartaric acid are formed.

Properties.—Crystallized tartaric acid is white and transparent, in the form of four-sided prisms, and containing about fifteen parts of water in the 100; it is not affected by exposure to the air; at the temperature of boiling water it becomes liquid; but when the heat is increased, it concretes into a hard mass on cooling, and seems to have undergone some change, for it has acquired a deliquescent property.

The taste is sharp and pungent, when it is diluted with water it resembles the taste of lemon-juice, and it strongly reddens blue vegetable colours; it is very soluble in water, and when much diluted is liable to decomposition. The constituent parts of this acid are oxygen, carbone, and hydrogen, and its saline compounds are denominated *tartrates*.

Sect. XXI. *Citric Acid.*

The sour taste of lemons and oranges is owing to citric acid; but as it exists in these fruits it is mixed with water and mucilage, from which it must be separated to procure it in a state of purity.

Preparation.—Having filtered a quantity of lemon juice, add powdered chalk as long as any effervescence continues; wash the white precipitate, which is a compound of citric acid and lime, with warm water, and add diluted sulphuric acid in sufficient quantity to saturate the lime; boil it for a few minutes, and, when cool, filter it. The filtered liquor being cooled and evaporated, affords crystals of citric acid.

Properties.—The crystals of citric acid are in the form of rhomboidal prisms, have a strong acid taste, with a slight odour of lemons, redden vegetable blues, and are soluble in less than their own weight of water.

Citric acid effloresces in a dry air, melts rapidly when exposed to heat, and frothing up, is reduced to the state of charcoal; it is converted into acetic acid by the action of sulphuric acid, and by nitric acid partly into acetic acid and partly into oxalic acid.

The constituent parts of citric acid are oxygen, carbone, and hydrogen; and the saline compounds are known under the name of *citrates*.

Sect. XXII. *Malic Acid.*

Malic acid exists in greatest abundance in the juice of apples, and hence the name is derived; but it is also found in other fruits, and in some it is nearly in equal proportion with citric acid, as in the cherry, gooseberry, and strawberry.

Preparation.—Bruise a quantity of sour apples, squeeze out the juice, and filter it through a linen cloth; saturate this juice with potash, and continue to add sugar of lead, dissolved in water, as long as any precipitation continues. The acetic acid of the sugar of lead combines with the potash and remains in the liquid, while the malic acid uniting with the lead, and being insoluble, falls to the bottom. After the precipitate is well washed with water, add diluted sulphuric acid, which combines with the lead and falls to the bottom, and the malic acid is set free, and remains in the liquid. By evaporation it may be obtained in the solid form, but it does not crystallize.

Properties.—In the state of liquid it is colourless when first prepared, but afterwards becomes brown by keeping; the taste is strongly acid; it is very soluble in water, and it reddens blue vegetable colours.

Malic acid is readily decomposed by heat; it exhales a thick acrid vapour, and leaves behind a bulky mass of charcoal; it is decomposed by the stronger acids; its constituent parts are oxygen, hydrogen, and carbone, and the saline compounds are denominated *malates*.

A pure and nearly colourless malic acid has been extracted from the juice of house-leek, in which it exists in combination with lime.

Sect. XXIII. *Saclactic Acid.*

This acid has been otherwise called mucous acid, because it is obtained from gum arabic and some other mucilaginous substances.

Preparation.—If one part of gum arabic be introduced into a retort with two parts of nitric acid, and a moderate heat be applied, while a little nitrous gas and carbonic acid gas are disengaged, a precipitate in the form of white powder, which is saclactic acid, falls down when the mixture cools; but as it is still impure, it requires to be digested several times in diluted nitric acid, to separate some portion of oxalate of lime; and a compound of gum and lime, which also adheres to it, may be separated by dissolving the acid in boiling water; when the water cools, pure saclactic acid is deposited. If sugar of milk be substituted for gum, the secondary processes are not necessary.

Properties.—The acid in the state of powder is white and gritty, with a weak acid taste. It is readily decomposed by heat, and yields an acid liquor, which crystallizes, on cooling, in the form of needles; a small portion of an acrid caustic oil, of a blood red colour, carbonic acid gas, and carburetted hydrogen gas, while a bulky mass of charcoal remains behind. It is sparingly soluble even in boiling water; the solution has an acid taste, and reddens the tincture of turnsole.

This acid is composed of oxygen, carbone, and hydrogen, and its saline compounds are denominated *saccolates* or *saclactates*.

Sect. XXIV. *Suberic Acid.*

Suberic acid derives its name from the word *suber*, which is the Latin name of cork, a singular production of a species of oak, the *quercus suber*, Lin. or cork-tree.

Preparation.—Suberic acid is obtained by grating down a quantity of clean cork, introducing it into a retort, and adding six parts of nitric acid. When the action of the acid ceases, evaporate the mixture to the consistence of an extract, pour over it hot water, and digest the mixture for some time in a sand heat; after cooling, a substance like wax appears on the surface, and a white flocculent matter falls down. These substances being removed, and the remaining liquid being concentrated by evaporation, suberic acid is precipitated in the form of powder. It has been observed, that crystals of oxalic acid are sometimes formed towards the end of the process. The powder is purified by washing in cold water.

Properties.—Suberic acid thus prepared has the whiteness of starch, with a slightly acid taste; it is not very soluble in water; it melts by the application of heat, and crystallizes in the shape of needles on cooling. It may be sublimed in close vessels, and it is condensed in the form of needles.

The constitution of this acid is probably the same with other vegetable acids, and its saline compounds are called *suberates*.

Sect. XXV. *Lactic Acid.*

In examining the spontaneous changes which take place in milk, Scheele discovered that it contains a peculiar acid, to which he gave the name of *lactic acid*.

Preparation.—If a quantity of whey of milk be evaporated to dryness, the extract obtained is composed of lactic acid, lactate of potash, muriate of potash, and phosphate of lime, beside a portion of animal matter. This mass being dissolved in alcohol, and mixed with alcohol, to which is added a seventy-sixth part of its weight of concentrated sulphuric acid, till the sulphuric acid appear in excess in the solution, a precipitate of sulphate of potash takes place. For the purpose of separating the other acids it is digested with carbonate of lead, till the liquid become of a sweetish taste. The sulphuric, phosphoric, and muriatic acids are thus separated, and the lactic acid, in combination with lead, remains in the solution. The lead may be precipitated by passing a current of sulphuretted hydrogen gas through the liquid, which is then to be digested over quicklime, till the whole of the animal matter is separated, and lactic acid, muriatic acid, and lime, remain in the solution. To a portion of the liquid, oxalic acid is to be added to separate the lime, and this portion being saturated with carbonate of silver, and added to the remaining liquid, separates the muriatic acid; the addition of oxalic acid precipitates the lime, and leaves the lactic acid in the solution. By evaporating to dryness, and again dissolving in water, it may be still farther purified from any remains of oxalate of lime.

Properties.—Lactic acid is of a brownish yellow colour, with a sharp sourish taste; it is never crystallized, but when evaporated to dryness has the appearance of a varnish which is deliquescent in the air. It froths up when heated, gives out a sour smell, and leaves behind a bulky mass of coal. The saline compounds of this acid, which are called *lactates*, are soluble in water, but do not crystallize.

Sect. XXVI. *Laccic Acid.*

This acid is obtained from the substance called *lac*, which is collected in the East Indies, and is the production of insects. Two kinds of lac are mentioned, *white lac* and *stick lac*.

Preparation.—A portion of white lac being subjected to heat, just sufficient to melt it, gives out about one-fourth of its weight of a reddish watery liquid, which, being filtered and purified, is found to be laccic acid. But by another process, stick lac is reduced to powder, and digested in water as long as any colour is given out; the aqueous solution being evaporated to dryness, the residuum is digested

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ed in alcohol; and this solution being also evaporated, the dry residuum is digested in ether, which latter being evaporated, leaves behind a mass of a light yellow colour, and of the consistence of syrup. This mass being redissolved in alcohol, to which some water is added, a portion of resin is precipitated.

The laccic acid, combined with a little lime and potash, remains in the liquid; the acid may be separated by means of lead; and the precipitate formed being decomposed by sulphuric acid, the laccic acid remains behind.

Properties.—Laccic acid crystallizes in the form of small needles; it is of a yellowish colour, with an acid taste, and is soluble in water; its constituent parts are probably similar to the other vegetable acids.

Sect. XXVII. *Gallic Acid.*

Gallic acid is obtained from nut galls, an excrescence which is produced on some species of oak, and hence it derives its name. The same acid exists in the bark and wood of other plants.

Preparation.—Reduce a quantity of nut galls to coarse powder, and add six parts of pure water; let the infusion macerate for two weeks, at a temperature between 70° and 80°; and after being filtered put it into a large glass, or earthen vessel, and expose it to the air, that it may evaporate slowly; a glutinous pellicle forms on the top, and mucous flakes are precipitated. The solution has now no longer an astringent, but an acid taste. At the end of two or three months a brown crust, covered with shining crystals of a yellowish grey colour, is formed on the sides of the vessel. These crystals were also found under the thick pellicle which covered the liquid, which being decanted, alcohol is added to the precipitate, the pellicle, and the crystalline crust, and with the assistance of heat the alcohol dissolves the crystallized acid, without touching the mucilage; and after the evaporation of this solution, the gallic acid is obtained in small shining crystals, of a yellowish grey colour.

By another process recommended by Deyeux, a French chemist, this acid may be more readily prepared. Nut galls being reduced to powder, are introduced into a large glass retort, and heat being slowly and cautiously applied, a large quantity of brilliant silvery crystalline plates, which are gallic acid, is sublimed. But in this process the heat applied must be very moderate, and must be withdrawn before an oil is disengaged, which instantly dissolves all the crystals.

A method of preparing gallic acid, proposed by Sir Humphry Davy, is by boiling together carbonate of barytes, with a solution of gall nuts; the liquid becomes of a bluish green colour, and by dropping into it diluted sulphuric acid, grows turbid, sulphate of barytes is deposited, and after the liquid is filtered, if the earth be fully saturated, a solution of pure gallic acid is obtained.

A fourth process suggested for preparing gallic acid is, by drying the crystals obtained by the first process, and subliming them in a glass vessel. In this way pure crystals of the acid are obtained, while the tannin, with which they are often contaminated, remains behind.

Properties.—Gallic acid, in a state of purity, is crystallized in transparent octohedrons, or brilliant plates; the taste is sharp and pungent, and the odour, when heated, is somewhat aromatic, but disagreeable. It is not affected by exposure to the air; it is soluble in 12 parts of cold water, and in two-thirds of its weight of boiling water; with a moderate heat, it rises into vapour, but every time it is sublimed it is partially decomposed. By repeated distillations gallic acid is converted into carbonic acid, carburetted hydrogen, and water, products which sufficiently indicate its constituent parts. It is decomposed by concentrated sulphuric acid, and charcoal is deposited.

The constituent parts of gallic acid are oxygen, carbone, and hydrogen, but the carbone is in larger proportion than in the other vegetable acids. The saline compounds of this acid are called *gallates*.

Gallic acid is peculiarly valuable as a test, or reagent, to discover metallic substances which are held in solution along with other bodies: its effects on metallic oxides are very various; with different metals it affords different coloured precipitates; and the more readily the metallic oxides give up their oxygen, the greater is the change produced on them.

Sect. XXVIII. *Prussic Acid.*

Prussic acid is one of the most important both to the chemist and manufacturer. It has been supposed that the ancients employed Prussian blue in painting; but it appears that the beautiful colours which are admired in the paintings of Herculaneum are derived from ultra-marine blue, and the smalt or azure of cobalt.

The discovery of Prussian blue was accidental. About the beginning of the 18th century, Diesbach, a chemical manufacturer of Berlin, wishing to precipitate a decoction of cochineal, alum, and green vitriol, by means of an alkali, borrowed from Dippel some potash on which he had distilled several times the animal oil which bears his name; but instead of a red precipitate, as he expected, a beautiful blue matter was thrown down by the addition of the alkali. Considering the ingredients which were brought into action, he found that he could produce at pleasure the same substance, which afterwards became an object of commerce, and from the place where it was discovered was called *Prussian blue*.

Preparation.—An extemporaneous alkali is prepared by detonating four ounces of nitre and an equal quantity of tartar, to which four ounces of bullock's blood, well dried, are to be added; calcine the whole with a moderate heat, in a covered crucible, having a small opening in the top, till the smoke or flame ceases to blacken any white body exposed to it. Towards the end of the process, increase the heat, till the crucible shall be moderately red. Throw the red-hot matter into four pounds of water, and boil it for half an hour, and having poured off the first water add another quantity, and boil again, and repeat the same operation till the liquid comes off insipid. All the quantities of water being collected together, are boiled down to four pounds; and this liquid has been called blood-ley, or phlogisticated alkaline ley.

Prepare a solution of two ounces of sulphate of iron, and eight ounces of alum, in four pounds of boiling water, and mix it with the solution of blood-ley while both are boiling hot; a great effervescence takes place, the liquid becomes greenish, inclining more or less to blue, and a precipitate is formed of the same colour. This precipitate being separated, the colour is heightened by adding muriatic acid till it no longer increases the intensity of the blue colour; it is then washed with water and slowly dried. Such was the process employed in the preparation of this remarkable substance before its nature and constitution were understood.

The researches of all the most celebrated chemists were directed to the discovery of the constituent parts of Prussian blue. Macquer, Bergman, and Scheele were particularly occupied in its investigation; and by the labours of the latter a method of separating the colouring matter was discovered.

Two parts of Prussian blue reduced to powder, one part of red oxide of mercury, and six parts of water, were boiled and continually stirred for a few minutes in a glass vessel; the mixture assumed a yellow-greenish colour; the whole was put on a filter, and two parts more of boiling water to wash it completely were poured on the residuum. This liquid is a solution of mercury combined with the colouring matter, which has a metallic taste, and is neither precipitated by acids nor alkalies. Pour this liquid into a glass vessel, after being filtered while it is hot, and when it is cooled add to it in a bottle two ounces of iron filings, and six or seven drachms of sulphuric acid; shake the mixture well for a few minutes, when it becomes black by the reduction of the mercury; the liquid then loses its metallic taste, and gives out the peculiar odour of the colouring matter. Decant the clear liquid into a retort, and, having adapted a receiver, distil with a gentle heat till one-fourth part of the liquid passes over. The liquid in the receiver is commonly mixed with a portion of sulphuric acid, from which it may be separated by a second distillation, with the addition of a little powdered chalk. The prussic acid is then obtained in a state of purity.

The following process is recommended by Gay-Lussac. A prussiate of mercury is prepared by boiling together red oxide of mercury and Prussian blue, and by evaporating the solution the salt may be obtained in crystals, which are to be introduced into a small tubulated retort, with a portion of muriatic acid, but less in quantity than what is required for the decomposition of the metallic salt. Let a glass tube, about two feet long, and about half an inch in diameter, be fitted to the beak of the retort, and fill the first third part of the tube with small fragments of marble, and the remainder with dry muriate of lime. The purpose of the marble is to combine with any portion of muriatic acid that may be driven over, and of the muriate of lime to retain the water. Let the tube terminate in a small receiver, which should be immersed in a freezing mixture of snow and salt; a moderate heat is then to be applied to the retort, and the acid is expelled and condensed on the marble, from which it may be separated and driven along the tube into the receiver by heat. *An. de Chim.* 95-145.

Properties.—Prussic acid is a colourless transparent liquid, with the odour of peach flowers, or of bitter almonds; the taste is sweetish at first, but soon becomes acrid and hot; it has no effect on vegetable blues; it has a strong tendency to assume the gaseous form, and is therefore soon dissipated when exposed to the air in open vessels. It boils at the temperature of 80°, and freezes at 5°.

When subjected to a high temperature it is decomposed, and by the action of light it is converted into carbonic acid, ammonia, and carburetted hydrogen gas. It combines with difficulty with alkalies and earths, which are readily decomposed by the action of carbonic acid, and are even acted upon by the portion that exists in atmospheric air. But this acid has the greatest tendency to form triple salts with alkaline and metallic bases, and these combinations are more permanent and fixed than the simple alkaline prussiates.

The constituent parts of prussic acid are carbone, azote, and hydrogen.

Prussous acid.—This acid is supposed to contain a smaller proportion of oxygen in its composition, but, according to others, it contains a portion of sulphur in addition to the constituent parts of prussic acid, or as a substitute for the hydrogen.

The acid which combines with a double base, forming the triple prussiates, is also supposed to be different in its constitution from prussic acid. According to the views of those who have investigated the nature and properties of these salts, this acid is a compound of oxide of iron and prussic acid.

Chap. X. Of Alcohol, Ether, and Oils.

The constituent parts of alcohol, ether, and oils, are carbone and hydrogen chiefly; but in some a triple compound of carbone, hydrogen, and oxygen exists, although the latter is not in such proportion as to exhibit acid properties, or these properties are concealed by the proportions of the other ingredients. These bodies are closely allied to the vegetable acids in their constitution, and some of them are to be considered as valuable instruments of chemical analysis. It is therefore of importance that their properties should be early known.

Sect. I. *Alcohol.*

When vegetable matters are subjected to the vinous fermentation, the fluid is converted into wine or beer; and this wine being distilled, the product of the distillation is a transparent liquid called alcohol, spirit of wine, or ardent spirit, which differs in flavour, colour, and strength, according to the nature of the materials from which it is obtained; and it is distinguished by different names. Brandy is the product of the distillation of the fermented juice of the grape, rum of that of the sugar-cane, and whisky of that of farinaceous substances. All these products are composed of alcohol, or pure spirit of wine, water, and an oily or resinous matter, to which the peculiar flavour is owing. No allusion is made to ardent spirit in the writings of the Greeks or Romans; it is supposed that it was known during the dark ages; but the preparation of it from wine, and even the discovery of alcohol, or pure spirit itself, is ascribed to Arnold de Villa Nova, who lived about the end of the 13th century, and was professor of chemistry at Montpellier.

Ardent spirit, as it is extracted from wine or beer, is a mixture of alcohol, water, and some oily and colouring matter. To purify it from these substances it is distilled several times; after the first distillation, it is called rectified spirits, but in this state it still retains a portion of water. To separate this portion it is to be distilled in a water bath till one-fourth of the quantity has passed over, and the same process is to be repeated several times, taking only the first half of the product. The different products being mixed together, the whole is to be distilled with a gentle heat, till the first half of the liquor passes over.

The alcohol, after these repeated distillations, is still combined with a portion of water. Various processes have been proposed to separate this water by the addition of substances which have a strong attraction for the water, and are nearly insoluble in the alcohol. For this purpose common salt of tartar, after being exposed to a red heat and reduced to powder, has been employed. But the alcohol is obtained in a state of greater purity by using muriate of lime which has been subjected to a red heat and reduced to powder; the salt while it is yet warm is to be put into a retort, and the strongest rectified spirits, nearly equal in weight, is poured over it at repeated intervals. Great heat is produced, arising, no doubt, from the condensation of the water in the saline compound; a sand heat is then applied to the retort, and the liquid being boiled the product is admitted into a receiver. The salt, with the alcohol, forms a thick solution, and the portion which first passes into the receiver is returned to the retort, and the whole is distilled to dryness.

Properties.—Alcohol is a transparent colourless liquor, with an agreeable smell, and a warm acrid taste; its powerful intoxicating effects are well known. The specific gravity of rectified spirits is rarely under .837, water being reckoned 1.000, and the strongest that can be obtained by distillation is about .820; but by the process just described for the separation of the water it has been reduced to .792 at 68°. It boils at 176°, and, when very strong, at a lower temperature, and rises into vapour in the vacuum of an air-pump at the temperature of 56°; it remains fluid when reduced as low as 91° below 0°. The freezing of alcohol at the temperature of 110° below 0° has been stated, but as no account of the process, has been published, the fact is still involved in some degree of mystery. When alcohol is passed through a red hot porcelain tube, it undergoes decomposition, and is converted into carbonic acid gas, carburetted hydrogen gas, and water. These products indicate the component parts of alcohol to be hydrogen, carbone, and oxygen, and in the following proportions, hydrogen 14, carbone 52, and oxygen 34.

A small portion of phosphorus dissolves in alcohol, which gives out the odour of phosphuretted hydrogen gas. If this solution be dropt into water in a dark place, a luminous appearance is produced on the surface of the water. Sulphur and alcohol unite only in the state of vapour, which being condensed, a reddish coloured liquid is formed; when the alcohol is very strong it dissolves a small portion also in the liquid state; when water is added to the solution the sulphur is precipitated. Sulphuric, nitric, and muriatic acids decompose alcohol, and afford a very peculiar product called ether.

Alcohol combines with water in all proportions, and the increase of temperature which is always produced, shews that a condensation of the two liquids takes place. The density varies according to the proportion of the alcohol and water which are mixed together; and, in consequence of this variation, it becomes an important object, both for the purpose of commerce and revenue, to be able to ascertain the quantity of alcohol in spirituous liquors of different specific gravities. With this view, instruments called hydrometers have been invented, and elaborate sets of tables have been constructed.

Alcohol is a valuable instrument of chemical analysis, because many saline substances which are soluble in that liquid may be separated from salts or from other extraneous bodies, that are insoluble.

Sect. II. *Ether.*

Alcohol is decomposed by different acids, and a fragrant volatile liquid, very different in some of its properties either from the alcohol or acid employed, is obtained. *Ether,* the product of this decomposition, is different in its properties, and has received different names, according to the acids which are employed in its preparation, as sulphuric ether, nitric ether, &c.

1. *Sulphuric ether.*—The mode of preparing sulphuric ether was published at Nuremberg about the year 1540; but it was not till the beginning of the 18th century that its nature and properties were much known.

Preparation.—Equal parts of concentrated sulphuric acid and alcohol are put into a retort, or, to avoid the violent action, let the acid be added at repeated intervals; the retort is to be placed in a sand-bath previously heated, and connected by means of an adopter with a tubulated receiver; to the tubulure of the receiver a glass tube twice bent at right angles is to be luted, and its extremity inserted in a small vessel of water or mercury. By this tube the elastic fluids which are not condensed are allowed to escape. The receiver itself must be kept cool by the application of wet cloths. When the liquid boils the ether is produced, and passes over into the receiver, and the boiling is continued till white fumes arise in the retort, or the smell of sulphurous acid is perceived. The receiver is then to be removed. The ether is generally contaminated with sulphurous acid; and for its purification a portion of the black oxide of manganese is put into a bottle with the ether and kept for 24 hours, during which time it is occasionally shaken; the clear liquid is then separated and distilled in a water-bath till one half come over. A portion of slaked lime also is recommended by some for the separation of sulphurous acid.

Properties.—Sulphuric ether is a transparent colourless fluid of a very fragrant smell, and a hot pungent taste; it is lighter than alcohol, the specific gravity being only 0.758, or when farther rectified

Of Alcohol, &c.

0.715. It boils in the open air at the temperature of 98°, and in the vacuum of an air-pump at so low a temperature as 20° below *zero;* it burns readily in the open air, and with a copious white flame. When the temperature is reduced to 46° below *zero*, it freezes and crystallizes. When passed through a red hot porcelain tube, carburetted hydrogen gas is obtained by its decomposition.

The constituent parts of sulphuric ether are stated at 14 of hydrogen, 68 of carbone, and 18 of oxygen.

Ether dissolves a small quantity of phosphorus; the solution is transparent, but becomes milky by the addition of alcohol; it also dissolves a small portion of sulphur, and the solution affords the smell and taste of sulphuretted hydrogen gas. Sulphuric acid converts ether into a peculiar liquid, called the sweet oil of wine.

2. *Nitric Ether.*

Nitric acid has a much more violent action than sulphuric acid on alcohol, so that it is necessary to moderate the effects of the two liquids by cooling the mixture; the first easy process proposed for the preparation of nitric ether was published in 1742, by Navier, a physician of Chalons.

Preparation.—Twelve parts of pure alcohol are introduced into a strong bottle, which is immersed in cold water or surrounded with ice. To this eight parts of concentrated nitric acid are to be added in small proportions, and the mixture is to be agitated after every new addition; the bottle is then stopped with a cork, which is secured with leather. The mixture is set in a convenient place to avoid the danger of accidents from the bursting of the bottle. In a few hours bubbles rise from the bottom of the vessel, and a stratum of ether is gradually formed on the surface of the liquid. When the action, which generally continues about six days, seems to be over, the cork is pierced with a needle to allow the escape of nitrous gas; and when this gas is gradually dissipated, the cork is withdrawn, and the whole liquid is poured into a funnel; the ether swims on the top, and the remaining liquid, which is heavier, is permitted to pass off, while the ether is retained.

The process contrived by Dr Black is attended with less danger. The nitric acid is first introduced into a bottle, and over this is poured gently a quantity of water, to which the alcohol, which swims on the top, is added. The proportions he employed were four ounces of strong nitric acid, three ounces of water, and six ounces of alcohol; the bottle containing the mixture was placed in water or ice, and the stopper was put in slightly in case of the sudden evolution of elastic fluids; and sometimes he applied a spring to the stopper, so that it returned to its place when the gaseous bodies pass off. By this contrivance, the mixture of the acid and the water on the one hand, and of the water and the alcohol on the other, proceed very gradually; at the end of eight or ten days three ounces of nitric ether are produced.

By whatever process it is obtained, it requires to be farther purified to separate the remaining acid and alcohol; this is done by distilling it from potash; the distillation is to be continued till one-half of the first ether has come over. A farther purification is still necessary, by mixing it with one-fifth of nitrous acid and distilling again; two-thirds of the product being taken and set apart to be rectified from an alkali.

Properties.—Nitric ether is of a yellowish colour; the odour is stronger and less sweet than that of sulphuric ether, and the taste is hot and more disagreeable. It burns with a more brilliant flame, and gives out a denser smoke. When long kept in a close vessel water is formed, holding a small portion of oxalic acid in solution, which falls to the bottom of the vessel. It is more volatile than sulphuric ether. Nitrous acid is formed in nitric ether, when it is kept for some time; and when it is passed through a red hot porcelain tube, carbonic acid, charcoal, nitrous gas, and some other substances are produced. This decomposition indicates the constituent parts of nitric ether, which, according to Thenard, are 48.52 oxygen, 28.45 carbone, 14.49 azote, and 8.54 hydrogen.

3. *Muriatic Ether.*

Two methods have been recommended for the preparation of muriatic ether.

By the first method, a portion of common salt is deprived of its water of crystallization, by keeping it for an hour in a state of fusion; 20 parts of the salt are put into a tubulated retort to which a bent tube is fitted, the extremity of which terminates in a bottle of Woulfe's apparatus, into which ten parts of the strongest alcohol have been introduced; and ten parts of concentrated sulphuric acid are to be added to the salt in the retort, in small portions at a time, while the air from the vessel with the alcohol is permitted to escape. The bottle with the alcohol being kept cool, the retort is placed in a sand bath, and the distillation continued till the muriatic acid passes over and saturates the alcohol. The product is again put into a retort and distilled, till about half the quantity comes over. This portion being washed by an alkaline ley, the ether, which swims on the surface, is separated.

By another process, equal proportions of muriatic acid and alcohol, both as strong as can be procured, are put into a retort, which is nearly of that capacity to contain the mixture. To diminish the violence of the ebullition, some grains of sand are put into the mixture, and a tube passing from the beak of the retort terminates in a large glass jar, furnished with three openings; a tube of safety is secured by a lute into the second opening, and from the third another tube passes into the pneumatic apparatus, to convey the gas that is evolved. With the application of heat, a portion of alcohol, with acid and water, is driven into the receiver; but the ether as it is formed passes off in the state of gas, and must be received in separate vessels.

Properties.—The gas of muriatic ether is colourless, has a sweetish taste, and the odour of sulphuric ether; it becomes liquid at the temperature of 52°, is then colourless, and in smell and taste is similar to the gas. It is extremely volatile, and at 64° assumes the form of elastic fluid; it burns with a greenish coloured flame, and during the combustion muriatic acid, in the state of vapour, is evolved.

The constituent parts of muriatic ether, according to the analysis of Thenard, are, muriatic acid 29.44, carbone 36.61, oxygen 23.31, hydrogen 10.64.

4. *Acetic Ether.*

Acetic ether was first obtained by distilling a mixture of acetic acid and alcohol. Equal quantities of strong acetic acid, such as is obtained from acetate of copper and alcohol, are distilled, and the product of the distillation is twice returned into the retort. After the third distillation the mixture is a compound of acetic acid and ether; potash is added to it to saturate the acid; and being again distilled, the ether passes off in a state of purity.

By another process, 15 parts of acetate of lead, 6 parts of strong sulphuric acid, and 9 parts of alcohol, being mixed together and distilled in a retort till ten parts pass over, and the liquid obtained being washed with a third part of its bulk of lime water, the ether which swims on the surface is separated.

Properties.—Acetic ether is similar in many of its properties to the other kinds; the taste is different, and it has a slight odour of acetic acid. It boils at the temperature of 160°, and burns with a yellowish white flame, and during the combustion acetic acid makes its appearance. Acetic ether is supposed to be a compound of acetic acid and alcohol, in which the properties of the acid are concealed; and hence its constituent parts are carbone, hydrogen, and oxygen.

Ether has also been formed by several other acids, which it would appear have one common property in their action on alcohol; and it has been supposed that all the ethers produced by the different acids are nearly the same, and would exhibit nearly the same properties, were it not that they are contaminated with extraneous matters, derived either from the acids or the alcohol employed in their formation.

Sect. III. *Oils.*

Oils, which are copious productions of nature, constitute a class of bodies which are characterised by combustibility, insolubility in water, and fluidity, and are of very extensive utility in domestic economy and the arts. The peculiar properties of different kinds of oils, form a very natural division into fixed or fat oils, and volatile or essential oils; the first of which, or the fat oils, require a high temperature to raise them to the state of vapour, but the second kind are volatilized with the heat of boiling water, and even at a lower temperature.

1. *Fixed Oils.*

Fixed oils are obtained either from animals or vegetables. Train oil is extracted from the fat or blubber of the whale, as well as from the liver of different animals; and it exists also in the eggs of fowls. Fixed oil is only obtained from the seeds of plants; and from those seeds which have two lobes, of which the seed of lint and the kernels of almonds, furnishing linseed and almond oils, are examples. They are sometimes called expressed oils, because they are obtained from the seeds by subjecting them to strong pressure.

Fixed oils are generally in the state of liquid, but of a viscid consistence; they have a greasy feel, are mild or insipid to the taste; when pure have no smell; are of a greenish or yellowish colour; are insoluble in water, leave a stain upon paper; and their boiling point is not less than 600°.

When exposed to the air, the fixed oils undergo peculiar changes; some of them become thick, opaque, white and granulated, and assume somewhat of the appearance of tallow. Oils subject to this change are called *fat oils*; and this is the case with olive and almond oil. But other oils by exposure to the air dry altogether, and retain their transparency; from this peculiar property they are called *drying oils*, and this property is improved in some of the oils by certain processes, as when linseed oil is boiled with litharge before it is employed by painters. But many of the fixed oils suffer decomposition when they are exposed to the air, and then they are said to become rancid. During this change the colour, smell, and taste are different, and an acid seems to be formed.

With the assistance of heat, phosphorus is dissolved in the fixed oils, and communicates a luminous property. Sulphur also, with the aid of heat, combines with fixed oil; and the solution, which is of a reddish colour, was formerly called *ruby of sulphur;* and when it cools slowly, the sulphur is crystallized into octohedrons. The mixture has a peculiarly fœtid odour, and affords by distillation a great deal of sulphuretted hydrogen gas.

Concentrated sulphuric acid decomposes fixed oil, water is formed, and charcoal is precipitated; nitric acid thickens it; and a mixture of nitrous acid and concentrated sulphuric acid produces inflammation.

2. *Volatile Oils.*

The volatility, fragrance, and acrid taste of volatile oils, afford sufficient characters to distinguish them from fixed oils; they are also called aromatic oils, from their odour, or essential oils, or simply essences.

Volatile oil is found in every part of the plant excepting in the seed from which fixed oil is derived; it is extracted either by simple expression when it is abundant, and is deposited in a fluid state in vesicles, as in the outer rind of the orange and lemon. But in most cases the substances which afford volatile oils are subjected to the process of distillation. After being macerated for some hours in water, they are introduced into a still along with the water; a moderate heat is applied and continued till the fluid boil, when the water rises in vapour, mixed with volatile oil, and is received in proper vessels. The oil collects on the surface of the water, from which it may be easily separated.

Properties.—Volatile oils are distinguished by their fragrance; some of them are thick and viscid, some congeal, and some of them assume a granulated solid consistence, and several of them are susceptible of crystallization. Some of them are nearly colourless, some are blue or green, but yellow or reddish is the prevailing colour; the taste is acrid, hot, and then caustic; the specific gravity is generally less than that of water.

Light deepens the colour, and increases the speci-

Of Alkalies.

fic gravity of volatile oils; they evaporate readily when exposed to heat, and burn with a bright white flame, with a copious evolution of smoke. Exposed to the air, they assume a deeper colour, become viscid, and exhale a strong odour; many of the volatile oils are in this way converted into resins by the absorption of the oxygen of the air; they are slightly soluble in water, and communicate to it their peculiar odour.

Phosphorus is soluble in volatile oils; the solution is luminous in the dark, very fetid, and when heated gives out phosphuretted hydrogen gas. The compound of sulphur and volatile oil, formerly called balsam of sulphur, affords sulphuretted hydrogen gas by means of heat.

Concentrated sulphuric acid produces a brown colour, and increases the viscidity of volatile oils; they are partially decomposed, and charcoal is deposited. Nitrous acid produces an instantaneous deflagration, and converts them into water and carbonic acid, and a bulky mass of charcoal remains behind.

Some of the volatile oils are employed in medicine; many of them are used in perfumery; and they are extensively applied for the solution of those substances which are employed as varnishes.

Tests.—The high price of some of the volatile oils is a strong temptation to adulterate them with other substances. When a volatile oil is contaminated with a fixed oil, it may be detected by an easy test: let a single drop of the suspected oil fall on clean paper, and expose it to a gentle heat; if the oil be pure the whole is evaporated without the slightest trace on the paper; but if adulterated with a fixed oil, a greasy spot remains behind. Oil of turpentine added to other volatile oils, is indicated by the smell; and when they are adulterated with alcohol, a little of the oil mixed with water produces a milky appearance.

Chap. XI. Of Alkalies.

The word alkali is derived from *kali*, the Arabic name of a plant from which that substance is extracted; and the particle *al* is prefixed to express the value or the qualities of the plant. Three substances, potash, soda, and ammonia, exhibit the peculiar characters of the alkalies; and they are distinguished by the following properties—the taste is disagreeably caustic; they convert vegetable blues to green; combine with water in all proportions; have a strong affinity for acids; melt in a moderate heat; and when subjected to a higher temperature rise in the state of vapour.

The alkalies have been divided into *fixed* and *volatile;* the first two, potash and soda, are denominated fixed alkalies, because a very high temperature is requisite to convert them into vapour, and the last, or ammonia, has been called volatile alkali, because it is volatilized by a very moderate heat.

Composition of the alkalies.—Conjectures had been frequently thrown out that the fixed alkalies are not simple substances; but no approach was made to ascertain their composition till the year 1807, when the brilliant discoveries of Sir Humphry Davy fully verified these conjectures, and proved, at least with regard to the fixed alkalies, that they are compounds of oxygen, with a metallic base.

Potash.—If a thin piece of pure potash, prepared according to the process to be detailed in the next section, and slightly moistened, be subjected to the action of galvanism between two disks of platina, it is soon fused, and oxygen gas is separated at the positive end of the battery, while small metallic globules appear at the negative extremity. These globules are the metallic base of potash, which has received the name of *potassium.* But as the potassium obtained by this decomposition is in very small quantity, and the process is expensive, more economical methods have been devised. According to one of these methods potassium is obtained by igniting potash with charcoal. But a more convenient method is to heat a quantity of iron turnings to whiteness in a curved gun barrel, and, to make fused potash come slowly in contact with the turnings; the potassium, as it is evolved, rises in the state of vapour, and is collected at the opposite extremity of the tube, part of which is purposely cooled to condense it. The nature of these processes is sufficiently obvious. The iron and the charcoal at a high temperature deprive the potash of its oxygen, and the metallic base being set free assumes the form of an elastic fluid, which becomes solid when it comes in contact with a cold body.

Properties of potassium.—Potassium is white, like newly cut silver, is hard and brittle, and has a crystalline appearance; at the temperature of 32° becomes soft, and malleable at 50°, and liquid at 100°. It is remarkable for its low specific gravity, which is between 8 and 9, water being stated at 10. Exposed to the air, it tarnishes in a few minutes, and, combining with oxygen, forms a crust of potash. It must therefore be kept under naphtha, the only substance in which it can be preserved free from change. When it is thrown on water it acts with great violence, swims upon the surface, and burns with a beautiful light, which is a mixture of white, red, and violet; the water is decomposed, the hydrogen escapes, and the oxygen, combining with the potassium, forms potash, which is dissolved and produces an alkaline solution.

Potassium combines readily with phosphorus and sulphur; with the first a phosphuret is formed, which burns in the open air, and is converted into phosphate of potash. In its combination with sulphur, light and heat are given out; and when the sulphuret is exposed to the air, it is soon changed into sulphate of potash.

The properties and combinations now enumerated afford satisfactory evidence of the compound nature of potash, and the proportion of the constituent parts are stated at 86 of potassium and 14 of oxygen.

Soda.—The decomposition of soda was effected by the same chemical philosopher about the same time, and in a similar manner; and to the metallic base the name of *sodium* has been applied.

Properties of Sodium.—Sodium, in many of its characters, is analogous to potassium; it is white like silver, with a high degree of lustre, melts at the temperature of 200°, and requires a red heat to raise it into vapour; the specific gravity is between 9 and

10; when it is exposed to the air it is soon tarnished, and covered with a crust of soda; it burns with great brilliancy when heated in oxygen gas, and when thrown into water it effervesces strongly, but is not inflamed, swims on the surface, and is gradually diminished, while the water becomes alkaline, with a solution of soda. In general the action of sodium is less powerful than that of potassium on other substances. It combines with sulphur and with phosphorus, and the compounds exhibit analogous properties, with similar combinations of potassium.

The constituent parts of soda are stated at 78 of sodium and 22 of oxygen; and it appears that the sodium combines with oxygen in two proportions and forms two oxides.

Ammonia.—Two of the constituent parts of ammonia, hydrogen and azote, have been long known; but after the discovery of the composition of the fixed alkalies, it was conjectured that ammonia, or the volatile alkali, possessing many analogous properties, might be constituted in a similar manner; and this conjecture receives some degree of confirmation from a galvanic experiment, in which mercury seems to enter into combination with the metallic base of ammonia, and to form an amalgam. To this base the name of ammonia is given. If about 50 grains of mercury be placed in the cavity of a piece of sal ammoniac slightly moistened, and if the sal ammoniac be connected, by means of a plate of platina, with the positive extremity of the galvanic battery, and a wire of platina, proceeding from the negative end, be brought in contact with the mercury, a strong effervescence is produced with the evolution of heat; the globule of mercury is enlarged in bulk, and assumes the appearance of an amalgam of zinc. At the temperature of 70° or 80°, it is of a soft consistency, and when reduced to the temperature of 32° it exhibits somewhat of a crystalline appearance. In the open air it is soon covered with a white crust of carbonate of ammonia; and when confined in a given quantity of air, the air is enlarged in bulk, ammoniacal gas and a portion of oxygen gas are given out, and the mercury is revived; but experiments are still wanting fully to establish the analogy of composition between ammonia and the fixed alkalies.

Sect. I. *Potash and its Combinations.*

Potash, formerly called vegetable fixed alkali, because it is obtained from vegetables, is known in commerce under different names. It is called *potash*, because it is prepared in iron pots, and *pearl-ash* from its appearance after farther purification, and it is well known under the name of *salt of tartar*. But in these states it is far from being pure. The potash of commerce is generally obtained from wood ashes, and the greater proportion of it which is employed in the arts of this country is imported from Russia and North America, where wood is abundant.

Purification.—The potash of commerce, or the salt of tartar of the shops, is generally mixed with extraneous substances, or is combined with carbonic acid, from all which it is necessary to be freed for many purposes. It may be purified by the following process: Potash being mixed with double its weight of quicklime, and 8 or 10 times its weight of pure water being added, the mixture is boiled for two or three hours in an iron vessel, after which it remains for 48 hours in a close vessel, and is occasionally agitated; it is afterwards filtered and boiled in a silver vessel, with a strong heat, till it assume the consistence of honey. Add a quantity of alcohol, equal in weight to about one third of the alkali employed, boil it for a few minutes, and then pour it into a bottle, and after it is cool it separates into three different strata; at the bottom are deposited solid matters; in the middle an aqueous solution of carbonate of potash, and the uppermost is a reddish brown liquid, which is a solution of pure potash in alcohol; the latter is carefully decanted off, and evaporated rapidly in a basin of silver, or of tinned copper, till a dry charry crust appear on the surface. Remove this crust, and pour the solution into porcelain vessels, and when it cools it becomes solid; it is then broken in pieces, and put into close vessels. This process is greatly improved by distilling the solution in alcohol in a silver still; the alcohol is driven off, and the pure potash remains behind.

Pure potash may be prepared by boiling together equal parts of purified salt of tartar, and white marble, or oyster-shells calcined, with a sufficient quantity of water, in a polished iron kettle. Strain the ley through clean linen, and reduce it by boiling till it contain about half its weight of caustic alkali. It is again passed through a linen cloth, and afterwards set by in a glass bottle, and when it becomes clear it is poured off from the sediment into another bottle, in which it is preserved for use in the liquid form.

Properties.—Potash is of a white colour, brittle, and of a crystalline texture; the taste is very acrid, and it is so corrosive that it destroys the texture of animal and vegetable substances. The specific gravity is 1.7.

When it is heated it melts, and when the temperature is raised to a red heat it is sublimed in the form of a white acrid vapour. Water dissolves double its weight of potash; the solution is colourless and transparent, and nearly of the consistency of oil. Sulphur unites with potash, and forms a sulphuret; and it readily combines with the acids, some of the compounds of which are of great importance. Potash is very soluble in alcohol, and the solution is of a red colour; it readily unites with the fat oils, and forms with them soft soap; and it combines sparingly with the volatile oils, and the compound is also of a soapy nature.

Sulphuret of Potash.—If one part of potash and three of sulphur be triturated together in a glass mortar, the mixture becomes hot, and acquires a greenish tinge, gives out a fœtid smell of garlic, attracts moisture from the air, and is almost entirely soluble in water. But if two parts of potash and one of sulphur be mixed together, and fused in a crucible, sulphuret of potash is obtained in the dry state. This substance was formerly called liver of sulphur, from its resemblance to the liver of animals. When the the fusion is completed, the mass is poured out on a marble slab, and covered up from the air till it cool, when it is broken into small pieces.

Properties.—The sulphuret of potash is of a shining brown colour, has a smooth and somewhat vitreous fracture, an acrid bitter taste, and when it touches the skin leaves a brown spot; it converts vegetable blue colours to green. With a strong heat in a close vessel the sulphur is sublimed, and the potash remains in a state of purity at the bottom of the vessel.

Hydrosulphuret of Potash.—When sulphuret of potash is exposed to the air it absorbs moisture, acquires a green colour, and exhales the fœtid odour of sulphuretted hydrogen gas; the water which has been absorbed is decomposed, and its hydrogen combining with a portion of the sulphur, forms sulphuretted hydrogen gas. This hydrosulphuret is prepared either by saturating potash, or it may be formed by dissolving sulphuret of potash in water, and evaporating the solution, when the hydrosulphuret is obtained in crystals, which are in the form of four-sided prisms. It has no smell, but the taste is alkaline, and very bitter; when exposed to the air it attracts moisture, and gives out a fœtid odour; it is soluble in water and in alcohol, and during the solution the temperature of the liquid is greatly reduced. Acids produce a violent effervescence, and expel the sulphuretted hydrogen, without the deposition of sulphur.

Hydroguretted Sulphuret of Potash.—If liquid hydrosulphuret of potash be poured upon sulphur, the latter is dissolved without the assistance of heat, and the liquid assumes a darker colour, and is converted into the hydroguretted sulphuret. The same compound may be prepared by boiling together a mixture of pure potash and sulphur in water; the liquid is of a deep red colour, inclining to brown; the taste is acrid, and somewhat cooling; sometimes it is without smell, but after being kept gives out the odour of sulphuretted hydrogen gas. This compound has a very powerful action on many substances, and particularly on metals; it readily absorbs oxygen when exposed to the air, and when kept in close vessels it deposits sulphur, the liquid becomes transparent, and the smell is dissipated.

Sulphate of potash.—This salt is a compound of sulphuric acid and potash. It has been distinguished by various names, as *sal de duobus*, *sal polychrestus*, or salt of many virtues; *arcanum duplicatum*, or double secret; and more lately *vitriolated tartar*, till it was denominated in the new nomenclature *sulphate of potash.*

According to the principles of the present chemical nomenclature, the saline compounds of acids with alkaline, earthy, or metallic bases, are distinguished by a name which is expressive of their composition. Two words are employed, the first of which, derived from the acid, is the generic term, and the second, taken from the base, refers to the species. Thus sulphate of potash indicates the compound of sulphuric acid and potash, and in this case the generic term ends in *ate*; but when acids, with a smaller proportion of oxygen, combine with bases, as in the case of sulphurous acid, the generic name terminates in *ite*, as sulphite.

In many cases acids and their bases unite together in different proportions. Sometimes the acid is in excess, and sometimes the base; in the present example, if sulphuric acid be in smaller proportion than it exists in sulphate of potash, the word *sub*, expressive of this under proportion, is prefixed, as *sub-sulphate* of potash. But if the acid be in larger proportion, the word *super* is prefixed, as *super-sulphate* of potash.

Sulphate of potash is prepared either by the direct combination of sulphuric acid and potash, or by the decomposition of other salts which have potash for their base, by means of sulphuric acid, which, from its stronger affinity for the potash, combines with it, and forms a new compound. When the solution is purified and evaporated the salt is obtained in crystals, but it forms regular crystals only by slow spontaneous evaporation.

Properties.—This salt crystallizes in short six-sided prisms, terminated by six-sided pyramids; the taste is disagreeably bitter; the specific gravity is from 2.4 to 2.6. One part of the salt is soluble in 16 times its weight of water at 60°, and requires only 5 times its weight of boiling water. It remains unchanged in the air, decrepitates when placed on burning coals, and at a red heat melts, and is converted into a kind of enamel. Exposed to a red heat, along with hydrogen gas or carbone, it suffers decomposition, and becomes a sulphuret of potash; the hydrogen and the carbone unite with the oxygen of the acid, and leave the sulphur in combination with the potash. Sulphuric acid, with the aid of heat, forms another compound with this salt, in which the acid is in excess.

The constituent parts of sulphate of potash, according to the analysis of different chemists, are from 43 to 47 of acid, and from 53 to 57 of base. It is supposed to be destitute of water of crystallization.

This salt was at one time much employed in medicine, and extraordinary virtues were ascribed to it.

Super-sulphate of potash.—This saline compound is prepared by heating together in a retort three parts of sulphate of potash with one part of its weight of concentrated sulphuric acid; it crystallizes in the form of long flexible slender needles; the taste is hot and acrid; it reddens vegetable blues, indicating an excess of acid; becomes slightly opaque when exposed to the air; requires two parts of cold water, and less than its own weight of boiling water for its solution; it melts readily by the application of heat, and presents the appearance of a thick oil, and, on cooling, becomes a white opaque mass. When subjected to strong heat, the excess of acid is expelled, and it is converted into sulphate of potash.

The proportion of acid in this salt is double of what it is in the sulphate of potash.

Sulphite of potash.—This salt is a compound of sulphurous acid and potash, and was long known under the name of the sulphurous salt of Stahl; it is formed by passing a current of sulphurous acid gas into a saturated solution of carbonate of potash, till the effervescence ceases; the liquid becomes transparent and hot; and, on cooling, white transparent crystals, in the shape of small needles diverging from a centre, or in romboidal plates, are formed; the taste is acrid and sulphurous; it is very soluble in water; exposed to the air, the solution is soon covered with a thick pellicle, which falls to the bottom, and is soon succeeded by another. This is the sulphate of potash, formed by the sulphurous acid combining with the oxygen of the atmosphere. Sulphite of potash, subjected to sudden heat, decrepitates, and is deprived of its water of crystallization and part of its acid; sulphur is separated, and what remains is sulphate of potash.

Nitrate of potash.—Nitrate of potash, which is a compound of nitric acid and potash, is a familiar substance in commerce and domestic economy, under the names of salt-petre and nitre. It is one of the most important saline compounds, not only on account of the attention which it has excited in the investigation of its nature and composition, but also on account of its numerous and valuable applications to the arts of life.

Nitrate of potash exists ready formed in some plants, as in tobacco and borage, and it has been observed crystallized in the form of needles in their dried stalks. It exists in great abundance on the surface of the earth in different parts of the world, especially in India, Egypt, and South America. It is produced artificially in Germany and France, by means of what are called *nitre-beds*, which are formed by collecting together the refuse of animal and vegetable matters in a state of putrefaction, and mixing them with earthy matters, but chiefly with calcareous earth, or with the rubbish from old buildings, or portions of the soil in which lime abounds. Moisture, which is supplied by the occasional addition of water to the mixture, a moderate temperature, and protection from the rain, which would wash away the salt as it is formed, are the only requisites which favour the production of nitre.

The nature of this process may be understood by considering the constituent parts of nitre. The base of nitric acid, azote, is separated from animal matters during the putrefactive process, in the form of azotic gas, which, at the moment of its evolution, unites with the oxygen of the air, and forms nitric acid, and the potash is furnished by the soil or the vegetable matters.

After a certain time, which is longer or shorter according to the nature of the ingredients and other circumstances, the nitre which is formed being mixed with water and evaporated, a brown coloured salt, which is called crude nitre, is obtained; it is a mixture of several salts, from which the pure nitre is separated by repeated solutions and crystallizations. After sufficient purification, it is obtained in the form of six-sided prisms terminated by six-sided pyramids.

Properties.—Nitrate of potash is peculiarly distinguished by a cool, sharp, and bitterish taste; is very brittle, and when large crystals are reduced to powder it is somewhat moist; but when it is in the form of a white opaque mass, it yields a dry powder. The specific gravity is 1.93; it is not changed by exposure to the air; water at 60° dissolves a seventh part of its weight, and great cold is produced during the solution; but boiling water dissolves twice its weight of the salt.

Nitrate of potash, when heated, melts and assumes an oily consistence; when cool, it congeals into an opaque mass called mineral crystal. This fusion produces no change, but when the temperature is increased, oxygen gas is given out, and afterwards azotic gas, while the potash remains behind.

Nitrate of potash is decomposed by means of charcoal; a violent action is produced by exposing a mixture of charcoal and nitre to a red heat; the carbone unites with the oxygen of the acid, and forms carbonic acid, azotic gas is disengaged, and the alkali remains behind, which was formerly called *nitre fixed by charcoal*, or an *extemporaneous alkali of nitre*. When this process was conducted in close vessels, a small portion of water appeared, and to this product the name of *clyssus* was given by the alchemists, who ascribed to it very wonderful properties in the preparation of the philosopher's stone. When phosphorus and nitre are heated in the same way, a violent deflagration takes place; but an experiment of this kind must be performed with great caution, and in very small quantities. Sulphur and nitre, when exposed to a high temperature, also exhibit a violent action. The sulphur combines with the oxygen of the nitric acid, forming sulphuric acid, which enters into combination with potash.

Fulminating powder is prepared with three parts of nitre, two parts of potash and one of sulphur, previously well dried and mixed together, by trituration in a mortar. This compound, when heated, produces a violent explosion.

Gunpowder is a compound of 76 parts of nitre, 15 of charcoal, and 9 of sulphur. The different ingredients which, it may be observed, are employed in different proportions by different manufacturers, are separately reduced to fine powder, and, after being well mixed, are formed into a thick paste with a little water; when the paste has dried a little, it is forced through a sieve, and reduced to grains of the requisite size; it is then dried in the air or the sun, put into barrels, which are turned round by means of machinery, and thus, by the friction of the grains upon each other, and against the sides of the barrel, they become smooth and polished. This is called *glazing* the powder. The terrible effects of the explosion of gunpowder, are accounted for by the changes which are instantaneously produced on the different ingredients of which it is composed. The sulphur and the charcoal burn with great rapidity by the addition of the nitre with which they are intimately mixed; and during this combustion, carbonic acid gas, azotic gas, sulphurous acid gas, and sulphuretted hydrogen gas, with a portion of water and ammonia, are formed; and it is obvious that its irresistible effects are owing to the sudden evolution and expansive force of these elastic fluids. Carbonate of potash, sulphate and sulphuret of potash, with some charcoal, are the substances which remain after the deflagration.

Black and white flux.—A mixture of equal parts of nitre and tartar, detonated in a red hot crucible, afford the compound called *white flux*, which is a mixture of pure potash with the carbonate, and is much employed in metallurgy. But if one part of nitre and two of tartar are treated in the same way, the product obtained is a mixture of potash and charcoal; from its black colour it is known under the name of *black flux*, and is applied to similar purposes.

Powder of fusion, which is so called from its powerful effects on metallic substances, is composed of three parts of nitre, one of sulphur, and one of sawdust. The different ingredients should be well dried, and thoroughly mixed together.

The constituent parts of nitre are 43 of acid, 40 of potash, and 17 of water.

Exper. 1.—Melt a quantity of nitre in a crucible, and when it is brought to a red heat, project into it a little powdered and well dried charcoal; at every addition of the charcoal a brilliant combustion takes place, in consequence of the rapid decomposition of the salt.

Exper. 2.—A similar effect is produced with phosphorus and nitre; but the danger of the experiment may be avoided by folding up in a paper a few grains of nitre, with a small quantity of phosphorus, both well dried, and striking the mixture smartly with a hammer on an anvil, or other solid body, a violent detonation takes place.

Exper. 3.—Take three parts of nitre, and one of sulphur, and project them in small quantities into a red hot crucible; a detonation takes place, and the sulphur is converted into sulphuric acid.

Exper. 4.—By combining the ingredients of gunpowder by two and two, as the nitre and the charcoal, and the nitre and the sulphur, and the charcoal and the sulphur, and setting fire to these compounds, and then mixing all the three ingredients in the usual proportions, their effects maybe distinctly observed.

Exper. 5.—Place a few grains of the compound called fulminating powder, on a plate of iron or copper, and hold the plate over the fire, the powder first assumes a dark colour, and then melts, and when the whole is in fusion, a violent explosion takes place; the heat should be applied slowly and gradually till the mixture is completely fluid, and then by bringing it nearer to the heat, the full effect of the explosion is obtained. This combustion and explosion are also owing to the instaneous evolution of elastic fluids, similar to what takes place at the explosion of gunpowder.

Exper. 6.—An amusing experiment is made with the powder of fusion. If a walnut shell be filled with this powder, and a thin plate of copper, rolled up, be inserted in the middle, and the powder be set fire to, it burns with great rapidity, and the metal is reduced to the state of sulphuret, without injury to the shell.

Nitrite of potash.—This salt is not formed by direct combination of nitrous acid with the alkali; but after nitre has been subjected for some time to a strong heat, a salt remains which is deliquescent and acrid, changes vegetable blues to green, and by the action of sulphuric, nitric, muriatic, and other strong acids, gives out red vapours, which are the fumes of nitrous acid.

Muriate of potash.—This salt, formerly called febrifuge salt of Sylvius, digestive salt, and regenerated sea salt, may be prepared by direct combination of muriatic acid and potash; the saturated solution is evaporated till a pellicle appears, when it is set by to crystallize. The crystals are in the form of cubes, or right angled parallelopipeds; the taste is bitter, and the specific gravity is 1.8. It deliquesces in moist air; cold water dissolves one-third of its weight; it is more soluble in boiling water; but regular crystals can only be obtained by slow spontaneous evaporation.

Exposed to heat it decrepitates, and is deprived of its water of crystallization; when the temperature is raised it sublimes unchanged in the form of white vapour.

It is decomposed by means of sulphuric and nitric acids; by the action of the first, muriatic acid is disengaged, and by means of nitric acid, oxymuriatic acid or chlorine, is separated. With one part of nitric acid and two parts of muriate of potash, a compound of the two acids, or nitromuriatic acid is obtained.

The constituent parts of this salt are 36 parts of acid and 64 parts of potash.

But according to the views of Sir Humphry Davy, relative to the constitution of muriatic acid, muriate of potash is a compound of chlorine and potassium, the metallic base of potash.

Hyper-oxymuriate, or chlorate of potash.—This saline compound, which possesses very remarkable properties, was first prepared by Dr Higgins, by passing a current of oxymuriatic acid gas into a solution of potash. He gave it the name of nitre, and observed that it detonated on red hot coals; but it was more accurately examined by the sagacious Berthollet.

Preparation.—If a quantity of potash, with six times its weight of water, be put into a bottle of Woulfe's apparatus, and a current of oxymuriatic acid gas be passed through it till the potash is saturated, crystals in the form of fine white scales fall to the bottom. These crystals being removed from the solution, are purified by dissolving them in boiling water; and the solution being filtered and allowed to cool, crystals are again deposited.

Properties.—The crystals of this salt are usually in the form of square plates or parallelopipeds, of a shining silvery white colour; they are transparent and brittle, and the taste is cool, pungent, and disagreeable. This salt becomes yellow by long exposure to the air, but remains otherwise unchanged; it is soluble in 20 parts of cold water, and boiling water absorbs one-third of its weight; it fuses quickly when exposed to heat, and when the temperature is increased it gives out a large proportion of the purest oxygen gas.

This salt exhibits very remarkable effects with combustible substances. Even when it is smartly rubbed, without any addition, it gives out sparks or luminous traces; but rubbed with charcoal, sulphur, phosphorus, various vegetable, and some metallic substances, it produces detonations. When sulphuric acid is poured on the salt, a violent action, with the evolution of white flame, takes place, and sometimes the vessel in which the experiment is made is shattered to pieces by the explosion. Nitric acid poured upon it occasions a crackling noise and effervescence, but without flame or explosion. Muriatic acid disengages the acid of the salt.

The constituent parts of this salt are 58 of acid, 39 of potash, and nearly 3 of water. According to the former views, the acid is a compound of muriatic acid, with a larger proportion of oxygen than what exists in oxymuriatic acid, and therefore it was called hyper-oxymuriatic acid; but, agreeable to the theory of Sir Humphry Davy, this acid is a compound of chlorine and oxygen, which has been already described in the chapter on acids, under the name of chloric acid. This salt was, at one time, employed in bleaching, but a similar compound, with lime, which is much cheaper, is now used as a substitute. Its remarkable power of detonation suggested its use in place of nitre in the composition of gunpowder; and an attempt was made in 1788, at Essone in France, to prepare it in the large way; but the spontaneous explosion of the mixture, which was attended with the fatal accident of the death of a lady and gentleman who witnessed the experiment, prevented its effects from being fairly tried.

Exper. 1.—Reduce two or three grains of the salt to a fine powder, and mix it well on paper with an equal quantity of finely powdered charcoal, and then rub the mixture strongly in a mortar, the charcoal will be inflamed, but with a very slight explosion; if a grain of sulphur be added to the mixture a more rapid flash, and a louder explosion are produced. For the success of this experiment, the materials, particularly the charcoal, should be perfectly dry, and the mortar should be warm, and in performing the experiment the hand ought to be protected with a handkerchief or glove. The carbone of the charcoal combines with the oxygen of the acid, and forms carbonic acid, which unites with the potash; and if sulphur be employed, sulphuric acid is formed, and the chlorine is set at liberty. The rapid decomposition is promoted by the friction.

Exper. 2.—Take two grains of the salt and about two-thirds of the same quantity of sulphur, reduce them separately to fine powder, and when they are well mixed together press the pestle of the mortar forcibly upon the mixture; a loud report, with a rapid flash of light, will be produced; or if the different parts of the mixture be successively subjected to pressure, the repeated explosions are like the smart cracks of a whip. This experiment may be varied by wrapping up the mixture of salt and sulphur in a piece of tinfoil, and striking it smartly with a hammer on an anvil. Similar changes take place in this experiment.

Exper. 3.—Reduce one grain of the salt to powder, and bring it together to one place at the bottom of the mortar, take a single grain of phosphorus, place it on the powdered salt, and rub it strongly with the pestle; a loud explosion instantly takes place, while a bright flash of fire is emitted. This experiment may be also varied by wrapping up the salt and phosphorus in tinfoil, and subjecting it to percussion; but in whatever way the experiment is made, every precaution to prevent the materials from being thrown about ought to be observed. The sudden changes are accounted for in the same way as in the preceding experiments.

Exper. 4.—Reduce five grains of the salt to powder, and mix it with six or seven grains of loaf-sugar; if a drop of concentrated sulphuric acid be added to the mixture it will be instantly inflamed, but without explosion.

Exper. 5.—Put six drachms, by measure, of nitrous acid into a tall ale glass, pour gently over it, down the sides of the glass, two or three drachms of water, that the two fluids may be kept separate; then drop in a bit of phosphorus not larger than the size of half a pea. If eight or ten grains of the chlorate of potash be added the phosphorus takes fire, burns vividly at the bottom of the vessel, and throws up brilliant streams of fire to the surface of the fluid. Caution ought also to be observed in this experiment.

Exper. 5.—If two or three drachms of spirit of wine be put into a tea-cup, and eight or ten grains of chlorate of potash be added, and if sulphuric acid, to the amount of two or three drachms, be poured on the mixture, small fire-balls of a blue colour dart from the fluid, and soon after the whole bursts into flame.

Phosphate of potash.—Phosphoric acid combines with potash in three proportions. In the first, or phosphate, the acid and alkali are saturated. It is formed by the direct combination of phosphoric acid and potash. Carbonate of potash is added to warm phosphoric acid till the solution produce no change on vegetable blue colours; by evaporating and cooling, transparent crystals in the form of four-sided prisms, terminated by four-sided pyramids, are obtained; the taste is cooling, the crystals undergo no change by exposure to the air, are very soluble in water, and become liquid when subjected to a red heat.

Super-phosphate of potash.—This salt may be prepared by dissolving the former in phosphoric acid to saturation; it is in the form of jelly, and scarcely crystallizes, is very deliquescent, and very soluble in water when subjected to strong heat.

Sub-phosphate of potash.—If pure potash be fused with the neutral phosphate, the sub-phosphate of potash is obtained, in which the base is in excess. A similar compound may be prepared by boiling the super-phosphate of potash in a solution of potash; a white powder, which is the sub-phosphate, falls to the bottom. It is nearly tasteless, only soluble in hot water, and is very fusible by heat.

Carbonate of potash.—This salt is a compound of carbonic acid and potash, and has been known under various names descriptive of its properties or of the substances from which it is extracted. It is obtained from vegetable matters by burning and washing out the salt from the ashes and evaporating the solution. But the potash thus prepared, besides being contaminated with foreign ingredients, is not fully saturated with carbonic acid. This compound is obtained by passing a current of carbonic acid through a solution of pure potash; the carbonate crystallizes at the surface of the liquid, and the crystals, after being dried on paper, must be kept in well closed bottles.

The carbonate of potash crystallizes in four-sided prisms, with two-sided summits; the taste is sweet and alkaline, and it changes vegetable blues to green; it is soluble in four times its weight of water; boiling water dissolves a larger proportion; and carbonic acid gas escapes during its solution in the latter, so that it is partially decomposed. It is not changed by exposure to the air; when heated, part of the carbonic acid is driven off; all other acids drive off the carbonic acid.

The constituent parts of carbonate of potash are 43 of carbonic acid, 41 of potash, and 16 of water.

Compounds of Potash.

Sub-carbonate of Potash.—The potash of commerce, or even when it is purified and known by the name of salt of tartar in the shops, is never fully saturated with carbonic acid ; and indeed it is proved by experiment, that it contains exactly one half of the carbonic acid which exists in the carbonate. It is also different in its other properties ; it is more acrid and corrosive, the taste is more strongly alkaline, and it is very deliquescent.

The potash of commerce is always contaminated with a portion of sulphate and muriate of potash, besides some insoluble matters.

Test of its purity.—It is of much importance to the manufacturer to be able to ascertain by a simple test the quantity of pure potash in the different kinds that are brought to market. The quantity of the earth of alum which the potash to be examined can precipitate, is proposed as one test ; that is, by adding the potash to a solution of alum in water, and observing the quantity of precipitate obtained from a determinate proportion of potash. Another test is, to saturate a portion of the alkali to be tried with nitric acid of known density. By repeated solution and crystallization, the other salts may be separated.

Arseniate of Potash,—Which is a compound of arsenic acid and potash, seems not to crystallize, is deliquescent, gives a green colour to syrup of violets, but produces no change on tincture of turnsole. Strongly heated, it melts into a white glass, and part of the potash combining with the silica and alumina of the crucible, it passes to the state of superarseniate ; when subjected to a red heat, in close vessels, the arsenic is sublimed, and it is decomposed by sulphuric acid. Salts, with a base of lime or magnesia are decomposed, and arseniates of lime or magnesia are formed in the solution.

Superarseniate of Potash.—If arsenic acid be added to the arseniate of potash till it no longer affect the colour of violets, but reddens the tincture of turnsole, the solution, when evaporated, yields transparent four-sided crystals, terminated by four-sided summits. It may be prepared by decomposing nitrate of potash, by means of white oxide of arsenic in equal proportions. It was called the *arsenical neutral salt of Macquer* ; and as it crystallizes, reddens vegetable blues, and is unfit to decompose salts with a base of lime or magnesia, its characters are sufficiently distinct from the former.

Acetate of Potash.—This saline compound of acetic acid and potash was known by various names, as *regenerated tartar*, *secret foliated earth of tartar*, *essential salt of wine*, &c. It may be formed by saturating carbonate of potash with distilled vinegar, and by slow evaporation with a very moderate heat, otherwise the acid is apt to be decomposed.

This salt has a slightly alkaline and pungent taste, is deliquescent in the air, is very soluble in water, and if the solution be diluted a spontaneous decomposition takes place in close vessels, with the deposition of mucous flakes. When heated, it melts and froths up, is decomposed and charred ; and when distilled it also suffers decomposition, and potash mixed with charcoal remains in the retort. The first product of distillation is an acid liquid in which, according to the experiments of Proust, ammonia and prussic acid are found, and, according to the same chemist, carbonate and prussiate of potash remain in the retort.

Oxalate of Potash.—This salt is prepared by saturating oxalic acid with potash ; but in this state the salt forms only a gelatinous mass. When there is a slight excess of acid or base, crystals in the form of six-sided prisms may be obtained. When two parts of carbonate of potash, and one part of acid are employed, the crystals redden the syrup of violets, and the tincture of litmus.

Superoxalate of Potash.—This saline compound, with an excess of acid, may be prepared by the gradual addition of potash to a saturated solution of oxalic acid, till a precipitation commences. The crystals are in the form of opaque parallelopipeds ; the taste is acid, pungent, and bitterish ; and they are not very soluble in cold water but dissolve in about ten times their weight of boiling water. They remain unchanged in the air, but are decomposed by heat. This salt contains double the proportion of acid which exists in the neutral compound.

In the plants called *oxalis acetosella*, or wood-sorrel, *rumex acetosa*, or sheeps-sorrel, this salt exists ready formed ; and because it is extracted from these plants, which are common in this country, it is distinguished by the name of *salt of sorrel.* It is employed under the name of *essential salt of lemons*, to remove ink stains and iron moulds, and is sold in the shops for that purpose.

Quadroxalate of Potash.—Another compound of oxalic acid and potash has been discovered, in which the proportion of acid is four times that of the oxalate. It is prepared by adding nitric or muriatic acid to the superoxalate, by whose action the latter is deprived of one half of its base. By evaporation and crystallization, the salt may be obtained in a state of greater purity.

Tartrate of Potash.—The compound of tartaric acid and potash, formerly denominated *soluble tartar*, is prepared by adding the *cream of tartar* of the shops to a hot solution of carbonate of potash till effervescence ceases ; and the solution being boiled for a little, filtered, and evaporated, till a pellicle appears on the surface ; after slow cooling, crystals in the form of long rectangular prisms, with two-sided summits, are deposited. This salt has a bitterish taste ; is deliquescent in the air ; four parts of cold water, but a smaller proportion of boiling water, are required for its solution ; it swells up and blackens when heated ; and when distilled yields an acid liquid, with great abundance of gas, and leaves behind the alkali mixed with charcoal. The stronger acids deprive it of part of the potash, and reduce it to the state of supertartrate ; and the same salt is formed by the addition of tartaric acid.

Supertartrate of Potash.—In this compound, as the name indicates, the acid is in excess. If the crust called tartar, found on the sides and bottom of casks in which wine has been kept, be dissolved in boiling water, filtered, and evaporated, crystals of the pure salt are copiously deposited as the liquid cools, and are well known under the name of *cream of tartar.*

The crystals are chiefly in the form of six-sided prisms ; the taste is acid, and somewhat unpleasant ;

and 60 parts of cold and 30 of boiling water are required for the solution of this salt. It is not changed in the air. By the action of heat, it froths up and blackens; and by distillation, an impure acetic acid is expelled, with a copious evolution of carbonic acid gas. The constituent parts are stated at 57 of acid, 33 of potash, and 7 of water.

Citrate of Potash.—This salt is prepared by dissolving about 61 parts of carbonate of potash in 36 parts of citric acid. The salt obtained by evaporation and cooling is little disposed to crystallize, is very soluble in water, and deliquescent in the air. It is composed of 55.55 acid, and 44.45 of potash.

Camphorate of potash.—Camphoric acid saturated with carbonate of potash till the effervescence ceases, affords by evaporation, with a moderate heat and cooling, crystals which are white and transparent, and in the form of regular hexagons. The taste of camphorate of potash is bitterish and slightly aromatic; in dry air it is not changed, but loses its transparency in moist air. Four parts of boiling water are sufficient for its solution, but it requires 100 parts of cold water.

Under the blow-pipe it gives out a blue flame, the acid is dissipated, and the base remains behind; when strongly heated the acid is sublimed, and it gives out a thick, slightly aromatic smoke. By the addition of the stronger acids to a concentrated solution of this salt, the camphoric acid crystallizes when the solution cools. Camphorate of potash is soluble in alcohol, and burns with a blue flame. It is decomposed by all salts having lime for their base.

Sect. II. *Soda and its Combinations.*

Soda, from the supposition that it existed only in the mineral kingdom, was formerly denominated *fossil or mineral alkali*, and it is the detersive substance mentioned in Scripture, under the name of *nitre*. It is a very abundant production of the soil in some parts of the earth, as in Egypt, where it is called *natron*, and it is sometimes found on the walls of caves or places under ground, or on old edifices. But the soda of commerce is extracted from different plants which grow near the sea shore,—as the *salsola soda*, from which the Spanish barilla ashes are obtained, and in this country, *kelp*, in which the soda is in a very impure state, is prepared by burning different species of *fuci* or sea-weeds. Common salt, so abundant in the waters of the ocean, and forming large solid masses in the earth in some parts of the globe, is a compound of soda and muriatic acid.

Soda and potash approach very nearly to each other in many of their properties, and indeed they were long confounded together. Oxalic acid has been proposed as a test to distinguish the two alkalies; a few grains of the solid acid being added to a solution of potash, forms with it a very soluble salt; but the compound with soda is nearly insoluble.

Soda may be purified by the same process which has been already described for the preparation of pure potash. When in a state of purity, it is usually in the form of solid plates of a greyish white colour; the taste is similar to that of potash, and it has the same caustic and corrosive property; it changes vegetable blues to green, and the specific gravity is 1.3. By slow evaporation from a solution in alcohol, it crystallizes in the form of prisms, and the crystals when exposed to the air soon effloresce and fall to powder. When exposed to heat, it liquifies and becomes of an oily consistence; with a red heat, it is raised to the state of vapour, which is extremely acrid and corrosive. When exposed to the air, it first becomes moist and soft by the absorption of water and carbonic acid, and when the air is dry, it effloresces and falls into powder; it has a strong affinity for water; when the dry alkali is moistened with water, it is absorbed, and becomes solid with the extrication of heat.

Soda is applied to similar purposes with potash; in some kinds of manufactures it is preferred to the latter, because it is less acrid and corrosive, and is therefore less apt to injure the texture of animal and vegetable substances which are subjected to its action.

Sulphuret of soda.—Sulphuret of soda is prepared according to the same process which is followed in the preparation of sulphuret of potash; and in most of its properties, it is analogous to the latter compound.

Hydrosulphuret of soda.—If a current of sulphuretted hydrogen gas be passed into a solution of soda, the gas is absorbed and condensed till the alkali be saturated. The compound thus formed is hydrosulphuret of soda, and it affords a crystallized salt in the form of four sided prisms, terminated by quadrangular pyramids. The crystals are transparent and colourless, without smell, but with a very bitter taste, very soluble in water, deliquescent in the air, and assuming a green colour, and decomposed by the action of acids which expel sulphuretted hydrogen gas.

Hydroguretted sulphuret of soda.—When dry sulphuret of soda is dissolved in water, the water is decomposed, part of the sulphur combines with the hydrogen of the water, and forms sulphuretted hydrogen gas, which combines with the sulphuret, and forms hydroguretted sulphuret of soda; the liquid becomes of a deep red colour; after being kept for some time, it acquires the smell of sulphuretted hydrogen gas; the taste is acrid, bitter, and cooling, and it communicates a green stain to the skin. This liquid has a very powerful action on metallic substances.

Sulphate of soda.—This salt is a compound of sulphuric acid and soda, which is well known under the name of Glauber salt. It may be prepared by the direct combination of the acid and alkali; but it is usually obtained by the decomposition of sea salt, by means of sulphuric acid in the manufacture of sal ammoniac. The solution being filtered, purified, and slowly evaporated, transparent crystals, in the form of six sided prisms, terminated by two sided summits, are obtained. This salt has a cool, bitter, and nauseous taste, effloresces in dry air, is very soluble in cold water, and requires for its solution only about three fifths of its weight of boiling water.

When it is exposed to heat, it first undergoes what is called the *watery fusion*, which is the separation of its water of crystallization, and when this is expelled a dry powder remains behind. When subjected to a long continued red heat, it melts again, and this is called the *igneous fusion*; but in these processes no change has been effected, for when it is dissolved in water and crystallized it returns to its former condition.

Sulphate of soda is decomposed by means of charcoal with a red heat; the acid is deprived of its oxygen, and a sulphuret of soda remains behind; its constituent parts are 23.52 of acid, 18.48 of soda, and 58 of water.

This salt is much employed in medicine; in chemistry it is applied to the decomposition of other substances, and in the arts for the extraction of soda.

Supersulphate of soda.—If the sulphate of soda be dissolved in sulphuric acid, and the solution be allowed to remain at rest, crystals are deposited which are in the form of large rhomboids; they contain an excess of acid, which is driven off with a moderate heat; they effloresce in the air, and are soluble in double their weight of water at the temperature of 60°.

Sulphite of soda.—This salt is a compound of sulphurous acid and soda, and is prepared by passing sulphurous acid gas into a saturated solution of carbonate of soda; a confused mass of small crystals is thus obtained, which being dissolved in warm water, crystallize again on cooling. The crystals are in the form of prisms, two sides of which are very broad, and two very narrow, terminated by two sided summits; and they are quite transparent.

This salt has a cool and sulphureous taste, effloresces in the air, is very soluble in water, and crystallizes again on cooling. The solution being exposed to the air, is converted into a sulphate; it readily undergoes the aqueous fusion, and if the heat be increased a portion of sulphur is driven off, and it is converted into a sulphate.

Nitrate of soda.—The compound of nitric acid and soda, formerly called *cubic nitre*, and *rhomboidal nitre*, is prepared by the direct combination of the acid and alkali, or by the decomposition of muriate or carbonate of soda by nitric acid. It crystallizes in the form of rhomboids.

The taste of this salt is cooling, but more bitter than that of nitre; it attracts moisture from the air, is soluble in three parts of cold water, and in less than its own weight of boiling water; it decrepitates on red hot coals, is less fusible than nitre, and, by decomposition, gives out oxygen and azotic gases. The constituent parts of this salt are 53 of acid, 41 of soda, and 6 of water, when dried in a temperature of 400°.

Muriate of soda.—According to the views of Sir H. Davy relative to the constitution of muriatic and oxymuriatic acid, the latter of which is a simple substance, which he has denominated *chlorine*, and the former consists of chlorine and hydrogen, this salt is not a compound of muriatic acid and soda, but of chlorine and sodium, the metallic base of soda; but whatever be its real composition, no salt has been more familiar to mankind from the earliest ages, from which it has been called *common salt*,—*sea salt*, because it is abundant in the waters of the ocean,---and *sal gem*, or rock salt, because it exists in the form of rocks or solid masses.

The greater proportion of the common salt of commerce is obtained from the waters of the ocean by evaporation with artificial heat; but in some parts of the globe, as on the shores of Spain, Portugal, and the Mediterranean; the sea water is admitted into ponds during the flowing of the tide, and its return is prevented by shutting the sluices; it is then slowly evaporated by the heat of the sun, and this process being conducted in creeks and bays of the sea, the salt is called *bay salt*.

Compounds of Soda.

But this process can only be followed in warmer and more temperate climates; in colder regions, artificial heat is generally employed in the manufacture of salt. The water is sometimes received in large ponds or flat vessels, where it evaporates in the open air; it is afterwards boiled in flat iron pans, and when the water is sufficiently concentrated, a pellicle forms on the surface, which is the crystallization of the salt; this falls to the bottom, and another pellicle is formed, till the whole of the salt is crystallized. The purity of the salt, as well as the size of the crystals, depends on slow evaporation, and hence it is, that the purest salt of this country is what is called *Sunday salt*, because it is obtained from the last quantity of water which is boiled on the Saturday night, and as it is allowed to cool slowly it evaporates gradually, and crystals of larger size and purer quality are formed.

A method of purifying common salt, proposed by Lord Dundonald, proceeds on the principle that the salts with which it is contaminated are more soluble than the muriate of soda itself. A quantity of common salt reduced to powder is put into a conical vessel or basket, which is slightly stopped at the apex, that the water may pass through, while it is placed in an inverted position; a saturated solution of common salt is then prepared, and poured boiling hot over the salt in the basket. It carries off all the more soluble salts with which it comes in contact, and, being saturated with common salt, has no effect upon it; but it must appear obvious that this is only a partial purification, because the solution cannot be brought in contact with every part of the common salt, unless the whole were dissolved.

For chemical purposes the muriate of soda must be purified by a different process. Dissolve it in four parts of cold water, filter the solution, and add to it a solution of soda, as long as any precipitate appears; evaporate the liquid, till small cubical crystals form on the surface. It may be obtained in larger crystals by slow evaporation. Common salt may be purified also by adding a solution of muriate of barytes, and then of carbonate of soda, while any precipitate is observed; the liquid is then filtered and evaporated till the solution crystallizes. By this process the earth of barytes unites with the sulphuric acid, which forms part of any compound in the solution, and the addition of carbonate of soda precipitates any of the earths which are in combination with muriatic acid.

The crystals of common salt are perfect cubes, but from this form several deviations take place; the taste is sweetish and agreeable, and is that which is properly called salt, with which similar tastes are compared. The specific gravity is 2.12. Common salt is not changed by exposure to the air. The deliquescence of the common salt of commerce is owing to its contamination with other salts; it is soluble in little more than two and a half times its weight of water, and it is almost equally soluble in hot and cold water.

Muriate of soda, subjected to a strong heat, decrepitates, and gives out its water of crystallization; melts in a red heat, and rises in white vapour; but it is unchanged, for the condensed vapour has all the properties of common salt.

Muriate of soda is decomposed by those acids which have a stronger affinity than muriatic acid for its base; by means of sulphuric acid it is decomposed for the purpose of procuring muriatic acid, and sometimes this salt is decomposed by the same acid to obtain the soda. The sulphuric acid forms sulphate of soda, while the disengaged muriatic acid is conveyed into a leaden chamber containing a solution of ammonia, where it forms sal ammoniac. The sulphate of soda, after being exposed to strong heat in a furnace, is mixed with its own weight of chalk, and half its weight of charcoal in powder; the mixture is strongly heated in a reverberatory furnace, and occasionally stirred to allow the sulphur and elastic fluids to escape; and the product is a black solid mass, composed of carbonate of soda, lime, and charcoal. More carbonate of soda may be extracted by solution in water, filtration, and evaporation.

But a process of this kind is too expensive to supply the manufacturer with this material; more economical methods, therefore, have been proposed. If common salt be mixed up with lime in the form of paste and exposed to moisture, the salt is decomposed, and an efflorescence of soda appears on the surface of the mass. The formation of soda in the soil of Egypt is accounted for on the same principle. Carbonate of lime, and muriate of soda, are abundant in the soil of that country; and wherever it is moistened with water, a copious production of carbonate of soda takes place.

With the same view of procuring the soda, common salt is decomposed by means of litharge of lead; in a mixture of four parts of litharge and one of sea salt with a little water, a decomposition of the salt is effected; the muriatic acid combines with the lead and is precipitated, and the soda remaining in the solution may be separated by filtration and evaporation.

Common salt may be decomposed also for the purpose of procuring the soda, by means of iron and other metallic substances. A plate of iron being dipped in a solution of salt, and exposed for some time to the air in a moist place, is covered with an incrustation of soda.

The constituent parts of muriate of soda, are stated at 46 of acid and 54 of soda; and considering it as a compound of chlorine and sodium, the proportions are 59.5 of chlorine and 40.5 of sodium.

In domestic economy and in many of the arts of life, no substance is of more importance than common salt; as a seasoning for food, it may be almost regarded as a necessary of life, and it is the fittest of all saline compounds for the preservation of animal matters which are intended for food. It is extensively employed in various metallurgical processes, in dyeing, and in the enamelling of stone ware.

Hyperoxymuriate or chlorate of soda.—This salt is prepared in the same manner as the compound with potash; but as the salt has nearly the same degree of solubility in water as the muriate of soda, it is difficult to obtain it in a state of purity; the crystals are in the form of square plates or rhomboids; it is soluble in three parts of cold water, and is also soluble in alcohol; it produces a cool taste in the mouth. Like the chlorate of potash, it is decomposed by means of combustible substances, as well as by acids. It melts when placed on hot coals, and gives out a yellowish light. According to the view of oxymuriatic acid being a simple substance, this salt is considered as a compound of chloric acid and soda.

Borate of soda.—This salt is a compound of boracic acid and soda, which is formed by saturating the acid with the alkali; but little seems to be known of its nature and properties.

Sub-borate of soda, or borax.—The ancients, it is supposed, were acquainted with this saline compound; and it was called *chrysocolla*, from its property of soldering gold and other metals. The word borax is derived from some of the Eastern languages. It was only in the beginning of the 18th century that the acid was separated from the alkali by Homberg, and it was long known under the name of *the sedative salt of Homberg.* Borax is a natural production of the earth in many parts of the world, and particularly of eastern countries. In India it is called *tincal*; and when it is brought into commerce it is distinguished by the name of crude borax. In this state it is in the form of small greenish crystals, intermixed with a greasy matter.

The purification of borax was originally in the hands of the Venetians; it was afterwards exclusively practised by the Dutch, and more lately has been conducted in this country. The repeated solutions and crystallizations which are found requisite, are performed in leaden vessels; and in one part of the process it is supposed lime-water is employed.

Purified borax is in the form of six-sided prisms, two sides of which are broader, terminated by three-sided pyramids; the taste is sweetish and alkaline; it changes vegetable blues to green, effloresces slightly in the air; and 12 parts of cold water and 6 parts at the boiling temperature, dissolve one of borax.

Borax melts with heat, assumes the form of a porous mass, and is converted into calcined borax; when the temperature is raised to a red heat it becomes a transparent glass, soluble in water.

As the name imports, the alkali is in excess in this compound, and its constituent parts are 34 of acid, 17 of soda, and 49 of water.

Borax is much employed as a flux for metals, and to promote the soldering of the more precious metals; it is used also as a flux for minerals, treated by the blow-pipe; and calcined borax is applied to eruptions of the mouth as an absorbent.

Phosphate of soda.—This compound of phosphoric acid and soda, was formerly known by the name of fusible or *microcosmic salt.* It is obtained by saturating, with carbonate of soda, the liquid acid phosphate, which is extracted from burnt bones by means of sulphuric acid. The alkali must be added in excess; and as the carbonate and a little phosphate of lime are precipitated in the solution, it requires to be filtered and evaporated till a thin pellicle appears on the surface, when it crystallizes by cooling.

The crystals are in the form of lengthened rhomboids, or of rhomboidal prisms; the taste is cooling and sweetish; it effloresces in the air; and four parts of water at 60°, and one-half of its weight of boiling water, are sufficient for its solution.

Exposed to heat it undergoes the watery fusion; melts in a red heat, and on cooling is changed into a white glass; and, under the action of the blow-pipe on charcoal, becomes opaque on cooling, and assumes a polyhedral form. By means of sulphuric, nitric, and muriatic acids, it is partially decomposed, and is converted into the superphosphate of soda. The constituent parts of this salt are stated at 20 of acid, 18 of alkali, and 62 of water; and it is much employed in medicine as a mild laxative.

Carbonate of soda.—This is the saline compound which is extracted from sea plants, especially from the fuci. The carbonate may be prepared by dissolving a quantity of the soda of commerce, in three or four times its weight of pure cold water, and then by filtering the liquid and evaporating till a slight pellicle is formed. This pellicle, which consists of small cubes of common salt, is to be removed, and the heat continued as long as any pellicle appears; after which the liquid is set aside to cool, and the carbonate of soda crystallizes.

The crystals are in the form of rhomboidal octohedrons, formed by two four-sided pyramids, truncated near the base; the taste is slightly acrid; it converts vegetable blues to green, effloresces speedily in the air, and is soluble in two parts of cold, and little more than its own weight of boiling water.

Exposed to heat it undergoes the watery fusion, melts in a red heat, and is converted into a transparent liquid. The constituent parts are 16 of acid, 22 of base, and 62 of water.

Supercarbonate of soda.—This compound, in which the acid is in double the proportion in which it exists in the carbonate, may be prepared by passing a current of carbonic acid gas into a solution of common carbonate of soda; a solid mass is deposited. This salt has been found native in some parts of Africa, and is so little changed by exposure to the air, that the walls of edifices are constructed of it in place of stone.

Arseniate of soda.—This compound of arsenic acid with soda, resembles the arseniate of potash in many of its properties. When the acid and alkali are saturated, it affords crystals in the form of six-sided prisms; but, with an excess of acid, it is deliquescent, and does not crystallize.

Acetate of soda.—The compound of acetic acid and soda, formerly known by the name of *crystallized foliated earth*, is prepared by saturating the acid and the alkali, filtering the solution, evaporating till a pellicle appear on the surface, and setting it aside to form crystals.

This salt crystallizes in the form of striated prisms like Glauber's salt; has a bitter pungent taste; is soluble in three parts of cold water, is decomposed by heat; and the residue, after distillation, has a phosphorescent property.

Oxalate of soda.—If two parts of crystallized carbonate of soda be dissolved in one part of oxalic acid, part of the oxalate of soda is precipitated, and part remains in the solution; which being evaporated affords crystals in small grains. This salt gives a green colour to the syrup of violets. Oxalic acid also forms an acidulous salt with soda.

Tartrate of soda.—Tartaric acid, saturated with soda, yields crystals in the form of fine needles; this salt combines with another portion of acid, and forms a supertartrate, which is less soluble in water.

Citrate of soda.—Citric acid and soda afford a salt which crystallizes in six-sided prisms; has a saline taste, effloresces in the air, and is soluble in two parts of water; when it is heated it froths up, and is converted into charcoal.

Benzoate of soda.—Benzoic acid and soda form a salt which readily crystallizes, has a sharp and saline taste, is deliquescent in the air, and very soluble in water.

Camphorate of soda.—A solution of carbonate of soda being saturated with camphoric acid, after evaporation with a moderate heat and cooling, yields crystals which are white and transparent, and not very regular. The taste of this salt is bitter; it effloresces in the air; is soluble in eight parts of boiling water; with heat it swells up; the acid is dissipated in thick aromatic vapours; and it burns with a blue flame. Under the blow-pipe the acid is sublimed, and the alkali remains behind.

Sect. III. *Ammonia and its Combinations.*

Ammonia is well known in familiar language, under the names of hartshorn, spirit of hartshorn, volatile alkali, and volatile spirit of sal-ammoniac. The name ammonia is derived from sal-ammoniac, a salt collected in the vicinity of the temple of Jupiter Ammon in Africa, which was frequented by camels and other animals in the train of those who visited the temple. Ammonia seems to have been first described by some of the alchemists in the 15th century; but it was not till towards the close of the 18th century that it was discovered to be a compound of hydrogen and azote, and its properties were fully investigated.

Preparation.—Three parts of quicklime and one part of sal-ammoniac in powder, being put into a retort, the beak of which is immersed under mercury, and a jar filled with mercury inverted above it, and heat being applied, a gas comes over in great abundance. This gas is ammonia or ammoniacal gas; sal-ammoniac is a compound of muriatic acid, and ammonia, and the lime having a stronger affinity than the ammonia for the muriatic acid, combines with it, and the ammonia being set free passes off in the state of elastic fluid.

Properties.—In its physical properties ammoniacal gas resembles common air; it is transparent and colourless, the smell is extremely pungent, and the taste acrid and caustic, but less corrosive than the other alkalies; 100 cubic inches weigh about 18 grains; it changes vegetable blues to green. It is

Compounds of Ammonia.

unfit for respiration and for the support of combustion.

When exposed to strong heat, as when it is passed through a red hot porcelain tube, it is decomposed, and converted into azotic and hydrogen gases; when the temperature is reduced to 45° below 0° it is condensed, and assumes a liquid form; but when the temperature is elevated it is restored to the state of elastic fluid.

The constituent parts of ammonia, it has been already stated, are hydrogen and azote, and the proportions of these elements in the gas are three volumes of hydrogen and one volume of azotic gas diminished to two volumes. These proportions have been obtained by the decomposition of dry ammoniacal gas by means of electricity.

Ammoniacal gas is rapidly absorbed by water. At the temperature of 50°, and when the barometer is nearly 30, water combines with 670 times its bulk of the gas; the specific gravity of the water is diminished. This solution is called liquid ammonia, and when it is exposed to the temperature of 130° the ammonia is driven off in the gaseous form: and when gradually cooled to 35° or 40° below 0° it crystallizes, and is then destitute of smell. When ammoniacal gas combines with water the latter becomes warm in consequence of the caloric which is given out by the gas as it combines with the liquid. The specific gravity of the water is always diminished by its combination with ammoniacal gas; but it varies with the different proportions of the gas, and the boiling point of the liquid is subject to similar variations.

Different products are obtained when ammoniacal gas and oxygen gas are inflamed by electricity, or are passed through a red hot porcelain tube, according to the proportions of the two gases employed. When the oxygen gas is in greater proportion the whole of the ammonia disappears, and nitrate of ammonia is deposited. Here part of the oxygen combines with part of the azote of the ammonia to form nitric acid, and another portion of the oxygen uniting with part of the hydrogen of the ammonia forms water, and the whole enters into the composition of the nitrate of ammonia. But when the ammonia is in excess it is entirely decomposed, a portion of its hydrogen forms water with the oxygen, and another portion is mixed with the azotic gas, which is set free.

Ammoniacal gas mixed with chlorine gas burns with a white flame, the ammonia is partially decomposed, the hydrogen of which uniting with the chlorine forms muriatic acid, and the latter entering into combination with the remaining ammonia forms sal-ammoniac; a portion of azotic gas remains behind.

Ammoniacal gas is absorbed by charcoal in the cold, without any change of its properties; but when it is passed over red hot charcoal it is decomposed; part of the carbone of the charcoal combines with the ammonia, or with its elements, and forms prussic acid.

Sulphuret of ammonia.—In the state of vapour, ammonia combines with sulphur, and forms a sulphuret, which, like the other sulphurets of the alkalies, possess the property of decomposing water and entering into new combinations.

Hydrosulphuret of ammonia.—If a current of sulphuretted hydrogen gas be passed through liquid ammonia, the solution becomes of a greenish-yellow colour, and is converted into the hydro sulphuret of ammonia. If equal parts of sal-ammoniac, lime and sulphur be distilled in a retort, a liquid of a deep orange colour is obtained; it exhales extremely fœtid vapours, in consequence, it is supposed, of retaining an excess of ammonia; and it was formerly called the *fuming liquor of Boyle.* When the fumes have passed off the excess of sulphur is deposited, and the hydrosulphuret remains behind in a state of purity. The hydrosulphuret of ammonia may be also prepared by combining sulphuretted hydrogen gas and ammoniacal gas together, and condensing them in a bottle kept cool by means of ice. It crystallizes in the form of needles, is transparent and colourless, and from its extreme volatility is sublimed at the top of the vessel in which it is kept.

Hydroguretted sulphuret of ammonia.—If hydrosulphuret of ammonia be poured on sulphur, it combines with a portion of the sulphur, and is converted into the hydroguretted sulphuret. The same compound may be obtained by separating the last portion of the liquid which comes over in the distillation of the fuming liquor of Boyle.

Sulphate of ammonia.—The compound of sulphuric acid and ammonia may be prepared by saturating the acid and alkali and afterwards crystallizing it. It was formerly called *secret sal-ammoniac* of Glauber, because it was discovered by that chemist.

The crystals of this salt are in the form of six-sided prisms, with unequal sides, terminated by six-sided pyramids; excepting in moist air it undergoes little change, is soluble in two parts of cold water, and in a smaller proportion of boiling water; melts with heat, and if the heat be continued is deprived of part of its base, and becomes a supersulphate, which reddens vegetable blues, and is more soluble. The constituent parts are 55 of acid, 15 of ammonia, and 30 of water.

Sulphite of ammonia.—This salt is formed by passing a current of sulphurous acid gas into a vessel of liquid ammonia. The solution being saturated, affords crystals on cooling.

The form of the crystals is similar to the sulphate, or in four-sided rhomboidal prisms, terminated by three-sided summits. This salt has a cool, pungent, and sulphureous taste; deliquesces in the air, and is converted into the sulphate; is soluble in its own weight of cold water, and a saturated solution, agitated in the open air, is, in a few hours, converted into the sulphate. The constituent parts are 60 of sulphurous acid, 29 of ammonia, and 11 of water.

Nitrate of ammonia.—The compound of nitric acid and ammonia is prepared by the direct combination of the acid and alkali, and is obtained in crystals by evaporation and slow cooling. It was formerly called *nitrous sal-ammoniac,* and *inflammable nitre.* It crystallizes in six-sided prisms; but the forms of the crystals vary with the temperature in which the evaporation goes on. The taste is acrid and bitter; it is deliquescent in the air; is soluble in two parts of cold water, and boiling water dissolves double of its own weight.

Nitrate of ammonia readily undergoes the watery fusion, is entirely deprived of its water of crystallization, and when the temperature is increased it explodes with the evolution of a brilliant white flame. The constituent parts of this salt afford an explanation of this rapid combustion. The hydrogen of the ammonia unites with the oxygen of the acid, water is formed, and the azote, the other element of both the acid and alkali, is disengaged, and appears in the form of azotic gas.

Nitrous oxide, which is a compound of azote and oxygen, is obtained from the decomposition of this salt; and it appears, from experiment, that in the different states of the crystallization of the salt, it requires different degrees of heat for its fusion and decomposition; but, in general, the dry nitrate of ammonia undergoes rapid decomposition between the temperature of 340° and 480°, and the prismatic and fibrous nitrates are decomposed at temperatures above 450. In preparing the nitrous oxide, or gas of paradise, for the purpose of being inhaled, it is necessary to attend to the temperature at which the salt is decomposed.

A singular explosive substance is obtained in the decomposition of nitrate of ammonia by means of chlorine. If a twelve ounce phial, filled with chlorine, be inverted over a weak solution of nitrate of ammonia at the temperature of 110°, the gas is absorbed, as appears from the solution rising in the bottle, and an oily matter is formed and falls to the bottom. This substance was first observed in France, and has been particularly examined by the chemists of this country. The colour approaches nearly to that of olive oil; the smell is extremely penetrating, and it is more volatile than ether. Under water, at the temperature of 200°, it is not decomposed, but at 212° it explodes with great violence. It produces also violent detonations when in contact with inflammable substances, as oil of almonds or phosphorus.

The water which is in contact with this substance freezes at the temperature of 40°, but the substance itself still retains its fluidity, and indeed continues liquid when subjected to very great cold. When kept in water it undergoes decomposition, and azotic gas is given out. It is decomposed also by muriatic acid; chlorine is disengaged, and muriate of ammonia remains in the solution.

In making experiments with this remarkable compound, the precaution should be strictly attended to of never employing more than a single grain, at least by the inexperienced. The constituents of this substance, which is denominated *chloride of azote*, are 19 of azotic gas and 81 of chlorine by bulk.

Muriate of ammonia.—The name of *sal-ammoniac* has been long familiar in chemistry and the arts. It is derived from Ammonia, a country of Lybia, and the name, which is derived from the Greek, and signifies *sand*, is descriptive of the soil of that region, where a temple was erected to Jupiter, who was also distinguished by the title of Ammon. The same salt seems to be a production of volcanoes, in the crater of which it is found sublimed; and the waters of some lakes in Tuscany hold it in solution.

The muriate of ammonia, as it is found in nature, is very impure; and therefore it is subjected to various processes to separate the foreign ingredients. In Egypt the animal matters which are impregnated with this salt are collected and burned in furnaces constructed for the purpose, and sometimes they are used as the common materials of fuel. The soot thus formed is said to be introduced into large glass bottles and exposed to a strong heat, which is gradually increased for three days, at the end of which the salt is sublimed in the form of a cake at the upper part of the bottles.

In the European manufactories this salt is prepared by different processes. The ammonia is extracted from soot or from animal matters, and with the addition of sulphuric acid is converted into sulphate of ammonia, which being mixed with common salt or muriate of magnesia, a double decomposition is effected, the sulphuric acid uniting with the soda or magnesia, and the muriatic acid combining with the ammonia. The different degrees of solubility of the new compounds afford the manufacturer an opportunity of separating them. The sulphate of soda or of magnesia is evaporated and crystallized in leaden vessels; and the muriate of ammonia, while in the state of a soft mass is put into large bottles and sublimed in the form of a cake at the upper part of the vessel.

Prepared by the process of sublimation, the muriate of ammonia is in the form of a solid mass, which has a slight degree of elasticity, yields to the pressure of the finger, and is with difficulty reduced to powder. The specific gravity is 1.4; the taste pungent and cooling. It is soluble in three or four times its weight of water, in which it crystallizes by slow evaporation in the form of long four-sided pyramids; but when the crystals are small, and the crystallization confused by rapid evaporation, the crystals exhibit a feathery appearance. Great cold is produced during its solution in water.

It is scarcely altered by exposure to the air, when it has been prepared by sublimation; but the crystals are deliquescent. It is fusible and volatile by heat; thrown on red hot coals, it rises in white vapour, and is entirely dissipated; and with a higher temperature it undergoes decomposition,

Muriate of ammonia is decomposed by sulphuric acid; the muriatic acid is separated with violent effervescence; and by the action of nitric acid a nitro-muriatic acid is prepared.

The constituent parts of this salt are 68 of acid, and 32 of ammonia. It is of great importance in dyeing, in the preparation of colours, in metallurgy, and some other arts; so that it is a valuable object of manufacture and commerce.

Hyperoxymuriate or chlorate of ammonia.—This saline compound is prepared by mixing carbonate of ammonia with a solution of any of the earthy chlorates, or by direct combination of the two constituents. It crystallizes in the form of fine needles; is very soluble in water and alcohol; is very volatile, has a sharp taste, and is decomposed by strong heat.

Phosphate of ammonia.—This salt was formerly

Compounds of Ammonia.

known by the names of *fusible and microcosmic salt.* It may be prepared by direct combination of phosphoric acid and ammonia. By slow evaporation of the solution to a proper consistence, crystals are obtained when it cools; but it is only by spontaneous evaporation that it crystallizes in regular forms, which are octohedrons, or four-sided prisms, terminated by four-sided pyramids, and oftener a confused mass of small needles. The taste is cooling and pungent; it changes the syrup of violets to green, and the specific gravity is 1.8.

This salt is slightly deliquescent in the air; is soluble in twice its weight of cold water, when heated undergoes the watery fusion, and melts into a transparent glass, which is acid in consequence of part of the base being dissipated. It is readily decomposed by charcoal and the stronger acids, as well as by the fixed alkalies.

The phosphate of ammonia is conveniently employed as a flux with the blow-pipe, in assaying mineral substances, and it is much used in the fabrication of coloured glasses, and in the artificial imitations of precious stones.

Phosphite of ammonia.—The compound of phosphorous acid and ammonia is prepared by direct combination of the acid and alkali; and by slow evaporation crystals are obtained, although it crystallizes with some difficulty, in the form of long transparent needles.

This salt is slightly deliquescent in the air, and is very soluble in water. Heated on charcoal under the blowpipe, it is first deprived of its water of crystallization, and is then surrounded with a fine phosphoric light; after which, when vitrification commences, bubbles of phosphuretted hydrogen gas are evolved, which explode when they come in contact with the air. The phosphoric acid remains after the decomposition.

Carbonate of ammonia.—The saline compound of carbonic acid and ammonia is well known under the name of *concrete volatile alkali.* It was formerly procured by the distillation of animal substances, and particularly horn, as the horns of the hart, from which it was called hartshorn. It is easily procured by mixing together two parts of chalk with one part of sal ammoniac, both well dried, and reduced to powder, and exposing them to heat in a retort. The muriate of ammonia is decomposed; the muriatic acid combines with the lime and remains in the retort, and the ammonia, uniting with the carbonic acid of the chalk, is sublimed in the form of a white crystallized mass. The carbonate of ammonia is collected in a proper vessel, which is kept cool with wet cloths.

The carbonate of ammonia crystallizes, but the crystals are small and irregular; the taste is slightly acrid, and the smell similar to ammonia, but weaker. It converts vegetable blues to green.

When it is pure, carbonate of ammonia is not perceptibly changed by exposure to the air; two parts of cold water dissolve more than one of the salt, and water, at the temperature of 120°, dissolves more than its own weight. Boiling water drives it off in the state of vapour, so that it cannot be employed for its solution.

Supercarbonate of ammonia.—The common carbonate of ammonia, dissolved in water, and exposed to the action of carbonic acid gas, combines with a larger proportion, and, by evaporation of the solution, crystallizes in the form of small six-sided prisms. In this state the salt is destitute of smell, and it has less taste.

Compounds of Ammonia.

Acetate of ammonia.—The compound of acetic acid and ammonia has been long known under the name of *spiritus mindereri*, in which state it is combined with an excess of acid. It may be prepared by saturating the acid and the alkali with each other, which can only be done when they are both in a state of concentration. The volatility of the compound renders the crystallization difficult, excepting by slow evaporation or sublimation, and then the crystals are long, slender, and flattened, pointed, and of a pearly white colour. The taste is cooling, with a mixture of sweet. This salt is deliquescent in the air, and very soluble in water.

Acetate of ammonia melts at 170°, and is sublimed at 250°. By distillation of the salt in solution with a strong heat, it undergoes partial decomposition. The ammonia rises first, then the acid, and, at the end of the process, part of the salt itself.

Oxalate of ammonia.—A compound of oxalic acid and ammonia is prepared by direct combination of the acid and alkali; the salt crystallizes after evaporation. When the acid is saturated with the alkali, the crystals are in the form of four-sided prisms, terminated by two-sided summits, one of which includes three sides of the prism; the taste is bitterish; one part of the salt is soluble in 20 parts of water, and it is insoluble in alcohol.

When oxalate of ammonia is exposed to heat, carbonate of ammonia is driven off, and nothing remains behind but a little charcoal. This salt is also decomposed by the mineral acids. With oxalic acid a new compound is formed, which is a superoxalate of ammonia; and the oxalates of potash and soda form compounds with this salt, which are distinguished by the name of *triple salts.*

Oxalate of ammonia is much employed as a reagent in detecting lime in liquid solutions, and it answers the purpose well of ascertaining the nature and proportions of calcareous salts.

Tartrate of ammonia.—The compound of tartaric acid and ammonia yields a salt which readily crystallizes, has a cooling bitter taste, is very soluble in water, and easily decomposed by heat. By the action of the stronger acids part of the base is separated, and a supertartrate of ammonia, which is less soluble in water, is formed.

Camphorate of ammonia.—This salt is prepared by adding camphoric acid to a solution of carbonate of ammonia in hot water, till the effervescence ceases. The evaporation must be conducted with a very moderate heat, on account of the volatility of the ammonia. This salt is not easily crystallized; when the solution is not too much evaporated it affords a crystalline mass, in which small needles appear; but when it is evaporated to dryness, a solid opaque mass, with a slightly bitter and pungent taste remains.

Camphorate of ammonia is slightly deliquescent, is not very soluble in cold water, but may be dissolved in three parts of boiling water. It dissolves entirely in alcohol; and an excess of base renders it more soluble. It melts on red hot coals, and then rises in vapour, gives out a blue and red flame under the blowpipe, and is at last entirely dissipated.

Chap. XII. Of Earths.

Those bodies which usually come under the denomination of earths are nine in number, 1. magnesia; 2. lime; 3. barytes; 4. strontites; 5. alumina; 6. silica; 7. yttria; 8. glucina; 9. zirconia. Of these earths, the first four enumerated are analogous to the alkalies in some of their properties; they are soluble in water, and they change vegetable blues into green; and from these properties they have been distinguished by the name of *alkaline* earths. The last five are insoluble in water, and have neither taste nor smell. They have been denominated *proper earths*.

The earths, like the alkalies, seem to be metallic oxides, that is, they are composed of oxygen, and a peculiar metallic base. Of the method of procuring these metallic bases, and of their general properties, the following is a brief exposition:

1. *Magnesium.*—The metallic base of the earth of magnesia is called magnesium. The earth is decomposed, by subjecting it, slightly moistened, and in contact with mercury, to the action of galvanism; an amalgam of mercury and magnesium is obtained by this process; the amalgam is then distilled in glass tubes, filled with the vapour of naphtha; but as the metallic base seemed to act upon the glass, it was difficult to procure it in perfect purity. Magnesium is a white solid metal, having a silvery appearance, heavier than water, and, when exposed to the air, it is soon converted into magnesia by the rapid absorption of oxygen.

2. *Calcium*,---is the metallic base of lime. A small quantity of pure lime being mixed with about a third part of its weight of red oxide of mercury was placed upon a plate of platina, which was connected with the positive extremity of the galvanic battery; into a cavity of the earthy mixture, a globule of about 60 grains of mercury was introduced, and the globule was connected with the negative end of the battery, by means of a wire of platina. By the galvanic action an amalgam was obtained, which was afterwards distilled in glass tubes, filled with the vapour of naphtha. The greater part of the mercury was driven off, but it seemed difficult to separate the whole. A solid globule having the appearance of silver, remained behind. This is the calcium, or base of lime. When exposed to the air for a few minutes it was restored to the state of lime by absorbing oxygen, and when heated in the open air it burns with considerable brilliancy, and the product of the combustion is quicklime. The small quantity of this base which has been yet procured, has precluded any minute examination of its properties. It has a greater specific gravity than water.

3. *Barium.*—The metallic base of barytes, called barium, is obtained by the same process of amalgamation and distillation. This metallic substance has also the colour of silver, is soon tarnished in the air, and is converted into barytes; it sinks readily in water, decomposes that liquid, and yields a solution of barytes; it melts at a heat below redness, and requires a high temperature to volatilize it.

4. *Strontium.*—By a similar process the metallic base of strontites, which is called *strontium*, is obtained. It is also a white solid metal, heavier than water, and nearly resembling barium. It is converted into the earth of strontites when it is exposed to the air, or brought into contact with water, by absorbing oxygen.

5. *Aluminum.*—The earth of alumina appears also to consist of a metallic base in combination with oxygen, but it has not been obtained in a separate state. A globule of iron being subjected to the action of galvanism, in contact with moist alumina, formed an alloy with its base. This base has been denominated *aluminum*. The alloy effervesces slowly in water, and is coated with a white powder, which seems to be the earth restored by the absorption of oxygen.

6. *Silicium.*—Silica, or siliceous earth, has been subjected to similar experiments, for the purpose of decomposing it. When potassium was passed through silica in a tube of platina, the potassium was converted into potash, by combining with the oxygen of the silica, and a dark-coloured substance, which is supposed to be the base of the silica, is separated. By some this base is supposed to be of a metallic nature, and is called *silicium*, and by others it is denominated *silicone*, from being analogous in its properties to carbone and borone, the bases of carbonic and boracic acids. This substance, whatever be its nature, unites readily with oxygen, and is converted into silica. From the latter view of the nature of the base of silica, it is considered by some as an acid, and, by a tolerable stretch of theory, has been set down among that class of bodies.

Yttrium.—The earth of yttria is also supposed to consist of a metallic base called *yttrium*, but it has not been obtained in sufficient quantity to ascertain its properties. When potassium is passed through yttria at a red heat, potash is formed, and particles of a grey colour, mixed with the alkali, are observed. These particles are supposed to be *yttrium*.

8. *Glucinum.*—The earth of glucina being subjected to a similar experiment, particles of a metallic nature were found mixed with the potash. These particles decomposed water, and, absorbing its oxygen, were converted into glucina, while the hydrogen gas is given out.

9. *Zirconium.*—The constitution of the earth of zirconia is supposed to be similar to that of the other earths, and its metallic base is called *zirconium*.

Sect. I.—*Magnesia and its Combinations.*

About the beginning of the 18th century magnesia was announced as a cure for all diseases; it was soon discovered to be the product of the calcined ley which remains after the preparation of nitre; but it was not till after the middle of the century that its different properties, as well as those of lime, and the alkalies in its mild and caustic state, were investigated by Dr Black. The nature of magnesian earth was still further elucidated by Bergman.

Preparation.---Magnesia is obtained in a state of

Compounds of magnesia.

purity by dissolving a quantity of Epsom salt in water, and precipitating the earth by means of potash, which, having a stronger affinity for the sulphuric acid, one of the elements of the Epsom salt, the earth of magnesia, which is the other, falls to the bottom. The precipitate which is thus obtained is to be well washed, both with cold and hot water, and afterwards dried.

Magnesia, when it is pure, is in the form of a fine white powder, has no smell, and no perceptible taste, but becomes dry, and leaves a sensation of bitterness on the tongue. It produces a slight change on vegetable blues, communicating a greenish colour. Magnesia is scarcely soluble in water; it undergoes no change in the air, excepting that it attracts a little moisture.

Sulphuret of magnesia.---A combination of sulphur and magnesia may be obtained either in the dry or humid way. Two parts of magnesia and one of sulphur, melted in a crucible with a very moderate heat, that the sulphur may not be driven off unchanged, yields an orange-yellow mass, which is not very soluble in water, but gives out the odour of sulphuretted hydrogen gas. The other compounds, with sulphur and hydrogen, are scarcely known.

Sulphate of magnesia.---This compound of sulphuric acid and magnesia is well known under the name of Epsom and Seidlitz salts, because it exists in the waters of the mineral springs which bear these names. The same salt forms a considerable proportion of the saline ingredients of sea-water; the bittern or mother-water of common salt, that is, the water which remains after the crystallization, consists chiefly of sulphate of magnesia. The salt may be purified by solution in water, and by evaporation and crystallization.

The crystals of sulphate of magnesia are in the form of four-sided prisms, terminated by four-sided pyramids; it has a cool, bitter taste; is soluble in its own weight of cold water, and in less than one-third of its weight of boiling water; effervesces in the air, and when heated undergoes the watery fusion. It is decomposed by the fixed alkalies, and, with ammonia, forms a triple salt.

The constituent parts of sulphate of magnesia, are 38 of acid, 18 of magnesia, and 44 of water.

Sulphate of ammonia and magnesia.---This compound is obtained by mixing together saturated solutions of sulphate of ammonia and sulphate of magnesia. Crystals of the triple salt are soon formed. It may be prepared also by adding ammonia to a solution of sulphate of magnesia; a portion of the magnesia is precipitated, which may be separated by filtering the solution; and, after evaporation and cooling, the triple compound crystallizes in the form of octohedrons. The taste is bitter and acrid; it does not effloresce in the air; but it is less soluble in water than the uncombined salts. It is composed of 68 parts of sulphate of magnesia and 32 parts of sulphate of ammonia.

Sulphite of magnesia.---The compound of sulphurous acid and magnesia is formed by passing a current of sulphurous acid gas into two parts of water with one of carbonate of magnesia; heat is given out with effervescence; the sulphite of magnesia falls down in the state of powder; and, with an excess of acid, being redissolved, affords crystals in the form of transparent tetrahedrons.

Compounds of magnesia.

This salt has a mild earthy taste, which soon becomes perceptibly sulphureous; has no smell; effloresces in the air, is converted into sulphate of magnesia, and is soluble in 20 parts of cold water.

Sulphite of ammonia and magnesia.—This triple salt is formed by mixing the solutions of the two salts, or by adding magnesia to a solution of sulphite of ammonia, or ammonia to the sulphite of magnesia. Transparent crystals are obtained, which, by exposure to the air, are converted into the sulphate by absorbing oxygen. This salt is less soluble in water than either of the two salts of which it is composed. Heat expels sulphurous acid; an acidulous sulphate of ammonia is sublimed, and pure magnesia is separated.

Nitrate of magnesia.—The compound of nitric acid and magnesia, formerly called *magnesian saltpetre*, is prepared by direct combination of the acid and earth; crystallizes by evaporation in four-sided rhomboidal prisms with oblique or truncated summits, or in the form of small needles in groupes; has a bitter penetrating taste; deliquesces in the air, and is soluble in its own weight of cold water.

It undergoes the watery fusion by heat; is decomposed at a higher temperature; gives out a little oxygen gas, then nitrous gas, and at last nitric acid, and the pure earth remains behind. It is composed of 46 acid, 22 magnesia, and 32 water.

Nitrate of ammonia and magnesia.—This triple compound is formed by decomposing nitrate of ammonia by magnesia. It crystallizes in fine prisms; has a bitter, ammoniacal taste; is less deliquescent in the air, and less soluble in water than either of the constituent salts, and when subjected to sudden heat bursts into spontaneous inflammation. When slowly heated in close vessels it undergoes decomposition, and gives out oxygen gas, nitrous gas, nitric acid, and a large proportion of water, but without any trace of ammonia; thus indicating that the hydrogen of the latter unites with the oxygen, and contributes to increase the proportion of water.

Muriate of magnesia.—According to the new doctrine of the constitution of the earth of magnesia and muriatic acid, this saline compound consists of chlorine and the metallic base of the earth, or is to be considered a *chloride of magnesium.* It exists in the waters of the ocean, and in some mineral waters, along with the muriates of soda and lime. By dissolving magnesia in muriatic acid to saturation, and evaporating the solution, small irregular crystals are obtained. But this salt is commonly in powder or in a gelatinous form; has a disagreeable bitter taste; deliquesces in the air; is soluble in its own weight of cold water, and is entirely decomposed by heat. Muriate of magnesia also forms a triple salt with ammonia.

Fluate of magnesia.—This compound of fluoric acid and magnesia is formed by combining the acid and earth, and by evaporating the solution it crystallizes in six-sided prisms, terminated by a low pyramid of three rhomboidal sides. But when fluate of potash is poured into a solution of sulphate of magnesia, the

Compounds of lime.

fluate of magnesia precipitates in the state of jelly, which after it dries is insoluble in acids.

Phosphate of magnesia.—This compound may be prepared by direct combination of phosphoric acid and magnesia, or by adding a solution of phosphate of soda to sulphate of magnesia; a double decomposition takes place, and in a few hours large transparent crystals are formed in the solution. They are in the form of six-sided prisms, with unequal sides, but the salt is frequently in the state of powder.

This salt has a sweetish cooling taste; effloresces in the air; is not very soluble in cold water, and requires for its solution 50 parts of boiling water. A triple salt with ammonia has been also formed.

Phosphite of magnesia.—This compound of magnesia with phosphorous acid may be prepared by mixing together solutions of phosphites of soda or of potash and sulphite of magnesia. The new compound is either in the form of shining white flakes or crystallized in tetrahedrons. It effloresces in the air, and requires for its solution 400 parts of cold water; when heated it swells up, and melts into a glass; gives out a phosphoric light under the blow-pipe, and becomes opaque on cooling.

Carbonate of magnesia.—This salt, which is sometimes called mild magnesia, is prepared by mixing together sulphate of magnesia and carbonate of potash in solution. By evaporating the solution, the carbonate of magnesia crystallizes in the form of transparent six-sided prisms, which soon lose their transparency in the air, are soluble in 48 parts of cold water, and, when exposed to heat in a crucible, slightly descrepitates, and, after the water and acid are expelled, fall down into powder. This salt has scarcely any taste. The magnesia of commerce is either in the state of powder or in light friable cakes; but it is not fully saturated with carbonic acid.

Acetate of magnesia.—Acetic acid forms a saline compound with magnesia, which does not crystallize, but remains in the state of a viscid mass; has a sweetish taste; leaving afterwards an impression of bitterness; deliquesces in the air, and is very soluble in water.

With oxalic, tartaric, citric, benzoic, camphoric, and some other acids, magnesia affords compounds, some of which are in regular forms, and are very soluble in water, and others are in the form of powder, and have little solubility.

Sect. II. *Lime, and its Combinations.*

Lime, which is met with in great abundance in nature, seems to have been employed for many purposes from the earliest ages of the world. As mortar and as manure it was well known to the ancients; and they were not unacquainted with some of its medical virtues.

Lime is universally diffused in nature, but it is seldom perfectly pure. In lime-spar, common limestone, chalk, or marble, beside being mixed with other substances, it is always in combination with carbonic acid. To obtain lime in a state of purity, a quantity of white marble is exposed to strong heat, by which the carbonic acid is driven off; after being calcined as it is called, and removed from the fire, water is poured upon it, which is rapidly absorbed with the evolution of heat, and the mass swelling up, at last falls down into powder, which is called quick lime, from its active properties. In this process of slaking lime, a great deal of water becomes fixed in the solid state, and parts with that portion of caloric which is necessary to retain it in the liquid form. The heat indeed is sometimes so great, that water may be boiled, and combustible substances inflamed. From this cause also accidents have happened to carriages and vessels loaded with unslaked lime, to which water had been admitted; the heat evolved was so great that they have been set fire to and destroyed.

Pure lime may be obtained by other processes. If a quantity of chalk be washed in pure water, dissolved in distilled acetic acid, and afterwards precipitated by carbonate of ammonia, the precipitate being washed and calcined, pure lime is the product. Oyster shells, well washed in different quantities of water, and boiled to separate any mucilaginous matters, calcined to whiteness in a furnace, and afterward exposed to a red heat in a porcelain retort, afford a very pure lime. Thus prepared, it ought to be preserved in close vessels, to exclude air.

Pure lime is of a white colour, has a hot caustic taste, destroys the texture of animal substances, and converts vegetable blues to green. It is soluble in water, of which 450 parts are required to dissolve one of lime. The solution of lime being filtered, is quite transparent, has a sharp acrid taste, and changes the syrup of violets to a green colour. If this solution be exposed to the air, it is soon covered with a pellicle, which acquires solidity and thickness in consequence of the carbonic acid of the atmosphere forming a carbonate of lime, and this, being insoluble in water, falls to the bottom. What has been called milk, or cream of lime, is quick lime reduced with water to the consistence of thick cream.

Lime may be crystallized artificially, by boiling a quantity of muriate of lime, to the extent of some pounds, to insure the success of the experiment, with about one fourth of caustic or quicklime, and evaporating the solution till a drop of it let fall on a cold stone acquire the consistence of syrup. Filter the solution, and introduce it into a close vessel, that it may cool slowly. Crystals of lime are in this way obtained, and require to be washed in alcohol, to separate any portion of muriate of lime that may remain.

Mortar.—In using lime for mortar it should be recently slaked, and the quantity of water employed should be just sufficient to bring it to a proper consistence. The following proportions have been recommended for a durable mortar: Four parts of coarse sand, three parts of fine sand, and one part of quick lime; and the addition of burnt bones, if not exceeding one-fourth of the lime, improves the tenacity of the mortar, and prevents it from cracking in drying; and to give it still greater solidity, it has been proposed to add a certain proportion of unslaked lime Three parts of fine sand, three of cement of well baked bricks, two of slaked lime, and two of unslaked lime, are said to form an excellent and durable mortar.

Compounds of lime.

Water cement.—As common mortar is unfit for the purpose of building under water, the addition of some substance which has the property of consolidating it, in such circumstances, is requisite. Manganese, it has been found by experiment, produces this effect. A good water cement is prepared by the following method: Mix together 90 parts of limestone, 6 parts of black oxide of manganese, and 4 parts of blue clay, all reduced to the state of powder; calcine the mixture, to expel the carbonic acid, and add 60 parts of sand, with a sufficient quantity of water to bring it to the consistency of mortar.

Phosphuret of lime.—Into the bottom of a glass-tube, closed at one end, introduce one part of phosphorus, and afterwards place a little above it four or five times its weight of quicklime in powder; expose that part of the tube which contains the lime to heat, till it become red-hot, and in this state raise the tube, and bring that part of it containing the phosphorus in contact with the fire. The phosphorus being raised to the state of vapour, combines with the lime; and the whole mass, which becomes of a brown colour, is converted into phosphuret of lime.

This phosphuret has no smell, falls to pieces when exposed to the air, and is insoluble in water, but decomposes that liquid when it comes in contact with it. An effervescence takes place, and phospuretted hydrogen gas, produced by the phosphorus combining with the hydrogen of the water, is given out, and spontaneously inflamed, when it reaches the surface.

Another change seems to take place during the action of the phosphuret of lime on the water. Part of the phosphuretted hydrogen combines with the phosphuret of lime, and forms a hydroguretted phosphuret; so that the phosphuret, when taken from the water, and dried, gives out flame when concentrated muriatic acid, which separates the phosphuretted hydrogen gas, is poured upon it.

Sulphuret of lime.—When sulphur and lime, reduced to powder, are heated in a crucible, they fuse slightly, and combine into an acrid reddish mass, which is the sulphuret of lime.

When this sulphuret is exposed to the air, it attracts moisture, or if sprinkled with a little water, it changes colour, and passes to a greenish yellow, giving out, at the same time, the fœtid odour of sulphuretted hydrogen gas, and then it is converted into a hydroguretted sulphuret. This compound is formed also when water is added to a mixture of sulphur and lime, or it may be prepared by heating in a matrass sulphur and lime in powder, with ten times their weight of water, or by heating lime-water on sulphur. The liquid thus obtained has a very fœtid odour, and a pungent acrid taste.

When sulphuretted hydrogen gas is passed into a bottle of lime-water, it combines with the lime, renders it more soluble, and forms the hydrosulphuret of lime. The lime thus saturated crystallizes; the crystals are without colour, and, when exposed to the air give out a very fœtid odour, are very soluble in water, and are decomposed by the acids with effervescence, while sulphuretted hydrogen gas is separated.

Sulphate of lime.—The compound of sulphuric acid and lime is well known under the names of *Gypsum*, *plaster of Paris*, and *alabaster*, and is a very abundant natural production.

Compounds of lime.

The sulphate of lime, when pure, is frequently found crystallized in four-sided prisms, with rhomboidal bases; but from this form numerous deviations take place. It is not changed by exposure to the air, and is very little soluble in water, requiring 450 parts of boiling water for its solution. Exposed to heat, it is deprived of its water of crystallization, becomes friable, and falls down into a white powder. When this powder is formed into a paste with water, it absorbs the liquid with great rapidity, and in a short time becomes solid. This peculiar property renders it extremely useful in making casts, under the name of *plaster of Paris;* but the common plaster of Paris contains a portion of carbonate of lime. Sulphate of lime, when strongly heated, becomes phosphorescent and then melts.

A variety of the sulphate of lime which is found native contains no water of crystallization, and is therefore called *anhydrons sulphate*; it is crystallized in rectangular prisms, has a pearly lustre, considerable hardness, is transparent, phosphoresces when heated, and is insoluble in water.

Sulphite of lime.—This salt is prepared by passing a current of sulphurous acid gas into a vessel of water, in which pure carbonate of lime in powder is diffused; an effervescence takes place, the sulphite falls to the bottom in the state of powder, and if the current of gas be continued after the effervescence has ceased, the powder is redissolved, the liquid becomes warm, and the salt crystallizes on cooling.

The crystals are six-sided prisms, terminated by long six-sided pyramids; it has no taste when first applied to the mouth, but becomes at last sulphureous; effloresces slowly in the air, and is converted into a sulphate of lime on the surface; and is less soluble in water than the sulphate. With a strong heat sulphur is separated, and it is then converted into sulphate of lime.

Nitrate of lime.—This salt is prepared by dissolving carbonate of lime in nitric acid, evaporating to the consistence of syrup, and after slow cooling it is obtained in crystals. This salt always accompanies nitre, and it remains in the solution from which nitre is crystallized; and hence it has been called *calcareous nitre*, and *mother-water of nitre*.

The crystals of nitrate of lime are in the form of six-sided prisms, terminated by long pyramids, or of long striated needles, of a silvery white appearance; the taste of the salt is acrid and bitter; it is extremely deliquescent, and so soluble that one part of cold water dissolves four parts; is very fusible with heat, and melts like oil; and when it becomes dry, acquires during calcination the property of becoming luminous in the dark, and hence it has been called *Baldwin's phosphorus*. With a stronger heat it is decomposed; nitrous gas, oxygen, and azotic gases are given out, and pure lime remains behind. It is also decomposed by sulphuric acid, partially by phosphoric acid, by potash and soda, and by double affinity, by means of the sulphates of potash of soda and of ammonia. In the latter cases, sulphate of lime, an insoluble salt, is precipitated.

This salt has been recommended as a substitute for nitre, in the extraction of nitric acid.

Muriate of lime.—This saline compound was denominated by the older chemists *calcareous marine salt*, and *fixed sal-ammoniac.* It is found in solution in some mineral waters; it is prepared by saturating muriatic acid with carbonate of lime, and evaporating the solution to the consistence of syrup; it crystallizes on cooling.

The crystals of muriate of lime are in the form of six-sided prisms, terminated by six-sided pyramids. This salt has an acrid and disagreeable taste; is extremely deliquescent, and so soluble that cold water takes up nearly double its weight. It melts by heat, and is deprived of its water of crystallization; at a high temperature part of its acid is driven off; and having an excess of lime, it acquires the property of shining in the dark, from which it has been called *Homberg's phosphorus.*

This salt is only employed in chemical experiments and particularly in the production of artificial cold, by mixing it with snow or pounded ice; and of all the saline compounds applied to this purpose it has the greatest effect, in consequence of its great solubility, and the rapid transition from the solid to the liquid state. To prepare the muriate of lime for this purpose, it should be evaporated to the consistence of a pretty thick syrup; and stirring it constantly as it cools, it is obtained in a dry granulated state, which should be reduced to powder when the temperature is at the freezing point, and put up in bottles which should be well secured to exclude the air.

But according to the new views of the constitution of muriatic acid and of the earths, muriate of lime is a compound of chlorine and calcium the metallic base of lime, in the proportion of 63 parts of the former and 37 of the latter.

Chlorate of lime.—This compound is prepared in the same way as the chlorate of potash. A quantity of pure white marble, in powder, is introduced into a bottle of Woulfe's apparatus; and a current of chlorine gas is passed into the liquid while it is warm, till the effervescence ceases. The solution acquires a pungent, styptic taste, and a reddish colour, and the salt at last crystallizes. This salt is very deliquescent, melts at a low heat in its water of crystallization, and is very soluble in alcohol. It has been much employed in bleaching.

Fluate of lime.—The compound of fluoric acid and lime, which is a very abundant natural production in some parts of the world, is well known under the names of *fluor spar*, *cubic spar*, *phosphoric spar*, or *Derbyshire spar*, from its form, some of its properties, the uses to which it is applied, or the place where it is found in great plenty.

According to the views of Sir H. Davy, this compound consists of fluorine and calcium.

When fluate of lime is prepared artificially, by combining the acid with the earth, it is always in the form of an insoluble powder. But as it is found native, it it is usually in the form of cubes, rarely with the angles or edges truncated, has considerable transparency, exhibits great variety of colours, particularly various shades of purple and blue, and is also insoluble in water. When heated, it decrepitates and appears luminous in the dark, and with a higher temperature it melts into a transparent glass. It is decomposed by the stronger acids, as well as by the carbonates of potash and soda, and most of the phosphates. The use of Derbyshire spar is well known for ornamental purposes.

Phosphate of lime.—This compound of phosphoric acid and lime forms the base of the bones of animals; and it is prepared by calcining a quantity of bones to whiteness, reducing them to powder, and washing them well with water to separate the soluble salts. It is now in the form of an insipid white powder, which often retains a portion of carbonate of lime; but from this latter it may be purified by means of diluted acetic acid, and washing it afterwards with water. The same compound is found native under the name of *apatite*, which is sometimes in masses, and sometimes regularly crystallized. It remains unchanged in the air, and is insoluble in water; a slight heat produces no change, but when exposed to a high temperature it is converted into a semi-transparent porcelain.

Superphosphate of lime.—This compound with the excess of acid, may be prepared by the partial decomposition of the phosphate, by means of any of the acids, which deprive it of part of the base, or by dissolving the phosphate of lime in phosphoric acid.

This salt crystallizes in the form of plates of a pearly lustre, or of small silky threads; has a strong acid taste, deliquesces in the air, and produces cold by its solution in water.

Phosphite of lime.—may be prepared by the direct combination of the acid and earth; when they are saturated, the salt is in the form of a white, insoluble powder, but with excess of acid forms small prisms or needles; is tasteless, and remains unchanged in the air. The neutral phosphite is soluble in acids without decomposition.

Carbonate of lime.—*Limestone*, *marble*, *chalk*, are carbonates of lime, so that it is a most abundant natural production, and is often crystallized in various forms. It is not changed by exposure to the air, and is insoluble in water.

In the artificial preparation of carbonate of lime, some nicety of management is necessary. The proportions of the acid and earth require to be accurately adjusted; for if too little acid be added, the first precipitate which is formed is redissolved in the water, and seems to form a carbonate with excess of lime. But if there be too much acid, the carbonate first precipitated is also redissolved, and disappears in the excess of carbonic acid.

When it is exposed to strong heat it is deprived of its water of crystallization; becomes white, opaque, and friable; and if the heat be continued, the whole of the carbonic acid is expelled in the state of gas.

The carbonate of lime is decomposed by all the acids, with effervescence; and its constituent parts are 44 of acid, and 56 of base.

Acetate of lime.—By dissolving carbonate of lime in acetic acid till it is saturated, and evaporating the solution till a pellicle appear on the surface, crystals of acetate of lime are obtained in the form of small prisms, and with a shining silky lustre. This salt has a sour, bitterish taste, is soluble in water, and is not changed in the air; it is decomposed by heat, partly by the separation of the acid, and partly by its decomposition. The constituent parts are 64 of acetic acid and water and 36 of lime.

Sect. III. *Barytes and its Combinations.*

The earth of barytes was discovered by Scheele in 1773. It received its present name from Mr Kirwan, and was so called from the Greek, signifying *heavy*, a term expressive of its great specific gravity.

If a quantity of sulphate of barytes, a mineral which exists in nature in considerable abundance, be reduced to fine powder, mixed with a ninth part of its weight of charcoal powder, and exposed in a crucible to a strong heat for several hours, the sulphuric acid is decomposed, and the sulphur remaining forms a sulphuret with the earth. This sulphuret being dissolved in water, and nitric acid added to the solution, a nitrate of barytes remains in the solution, while the sulphur is precipitated. The filtered solution being slowly evaporated, crystals are formed, which, being exposed to strong heat in a crucible, the acid is decomposed and expelled, and the earth of barytes remains behind in a state of purity.

By another process, which is more economical, the sulphate is decomposed as before, and to the filtered solution of the sulphuret carbonate of soda is added, a precipitate in the form of a white powder takes place. This powder is to be washed with water made up into balls with charcoal, and exposed to a strong heat in a crucible. The balls being thrown into boiling water, part of the barytes is found dissolved, and as the water cools it crystallizes.

The earth of barytes, as it is prepared by the decomposition of the nitrate in the first process, is in the form of small grey porous masses, has a hot burning taste, and when taken into the stomach proves a deadly poison, destroys the texture of all animal substances, converts vegetable blue into green, is analogous to the fixed alkalies in many of its properties; exposed to the air, especially to moist air, it soon swells up, becomes hot, and falls into a white powder; if water be thrown upon barytes it boils up, is strongly heated, and enlarged in volume after being thus slaked, if it be diluted with water, it crystallizes in the form of needles; boiling water dissolves half its weight of pure barytes, cold water takes up about one-tenth of its weight. When the crystals of the earth of barytes are exposed to the air they fall down into powder by attracting the carbonic acid.

Phosphuret of barytes.—If a mixture of barytes and phosphorus be introduced into a glass tube closed at one extremity, and subjected to heat, the two substances rapidly combine, and a phosphuret of barytes is formed. It is of a dark or shining brown colour, having a metallic appearance, very fusible, and exhaling, when moistened, a strong fœtid odour; is luminous in the dark; when thrown into water is decomposed with the evolution of phosphuretted hydrogen gas, and is gradually converted, by the action of the air and water, into phosphate of barytes.

Sulphuret of barytes, &c.—Sulphur and barytes being well mixed together, and subjected, in a crucible, to a red heat, combine and form a sulphuret. This substance is very soluble in water, which is decomposed with great rapidity; sulphuretted hydrogen gas is evolved, which uniting with the sulphuret, forms the compound called hydrosulphuret of barytes. This hydrosulphuret crystallizes sometimes in the form of small needles, sometimes in that of six-sided prisms, or of octohedrons or small shining plates. Barytes forms also, with sulphur, a hydroguretted sulphuret, that is, sulphuretted hydrogen combines with another portion of sulphur, and unites with the barytes; and this hydroguretted sulphuret of barytes gives out, by the action of acids, sulphuretted hydrogen gas, while sulphur is at the same time deposited.

Sulphate of barytes.—This compound of sulphuric acid and barytes is an abundant natural production, and was formerly distinguished by the name of *heavy spar, phosphoric spar*, or *Bolognian stone.*

The sulphate of barytes, which is rarely prepared artificially, is remarkable for its great specific gravity, which is 4.4. It is often in a compact form, but sometimes crystallized; it has neither taste nor smell, remains unchanged in the air, and is insoluble in water. When suddenly heated it decrepitates, and when strongly heated it melts with difficulty; it fuses under the blow-pipe, and is converted into a white opaque globule.

Sulphate of barytes, mixed with charcoal, and subjected to a red heat, is decomposed and changed into a sulphuret, which has a phosphoric property. This compound was called *Bolognian phosphorus*, in consequence of having been first observed in the neighbourhood of Bologna. The sulphate of barytes is also decomposed by the carbonates of potash or of soda, either by exposing them to a strong heat in a crucible, or by boiling them together in solution.

Sulphite of barytes.—If sulphurous acid, in the state of gas, be passed into water, having carbonate of barytes mixed or suspended in it, a compound, either in the form of powder, or crystallized, is formed.

The crystals are in the form of tetrahedrons, or of brilliant opaque needles. This salt has scarcely any taste, it is not altered by exposure to the air, and is insoluble in water. It has been employed as a test to ascertain the purity of sulphurous acid, for if it be contaminated with sulphuric acid, a precipitate takes place, with the addition of sulphite of barytes.

Nitrate of barytes.—This compound is prepared, either by the decomposition of sulphuret of barytes, by means of nitric acid, or by saturating nitric acid with the native or artificial carbonate of barytes. When the artificial carbonate is employed it is recommended to wash it well with distilled water till the washing cease to precipitate nitrate of silver. By filtration and evaporation the salt is obtained crystallized in small brilliant plates, or in regular octohedrons.

This salt has a hot, austere taste, is little changed in the air, is soluble in twelve parts of cold, and in three or four of boiling water. Placed on burning coals it decrepitates, froths up, and becomes dry, and when heated in a retort gives out a little water, oxygen, and azotic gases, and pure barytes, in the form of a solid grey porous mass, remains behind. By this process the pure earth is prepared.

Nitrate of barytes is a useful test for detecting sulphuric acid or its combinations in any solution.

Muriate of barytes.—This salt is prepared by the direct combination of diluted muriatic acid, with the native or artificial carbonate of barytes, or by adding muriatic acid to the sulphuret in solution in water. This solution being filtered, evaporated till a pellicle appear on the surface, and slowly cooled, affords crystals of muriate of barytes; but as iron is sometimes dissolved with the barytes, it may be separated by the addition of liquid ammonia, or by calcining the mixture, the acid is driven off, and the iron remains behind in the state of oxide, which is insoluble in water.

The muriate of barytes crystallizes in eight-sided pyramids, or in the form of tables bevelled at the edges. The taste is acrid, astringent, and somewhat metallic; it is not changed by exposure to the air, is soluble in three or four parts of cold water, decrepitates when heated, loses its water of crystallization, dries, falls down to powder, and at last melts, but is not decomposed by the strongest heat.

Muriate of barytes is one of the most delicate tests of sulphuric acid in its solutions.

But according to the new views of the constitution of muriatic acid, muriate of barytes is to be considered as a compound of chlorine and barium, or the metallic base of barytes, and is therefore a chloride of barium.

Carbonate of barytes.—The carbonate of barytes is a natural production, but is rarely met with. It may be prepared artificially, by exposing a solution of pure barytes to the air, or by passing a current of carbonic acid gas into a solution of the earth, or by the decomposition of sulphate of barytes, by means of carbonate of potash or of soda.

By whatever process it is prepared, it is in the form of a white, tasteless powder; remains unaltered in the air, and is very sparingly soluble in water.

Acetate of barytes.—This salt may be prepared by the direct combination of the acid with the earth, or by the decomposition of the sulphuret of barytes by means of acetic acid. By evaporating the solution, the salt crystallizes in fine transparent prisms.

This salt has an acid bitter taste, effloresces in the air; is soluble in water, and is decomposed by the fixed alkalies, the alkaline carbonates, and by most of the sulphates.

The acetate of barytes is conveniently employed to detect sulphuric acid in its solutions, and particularly in vinegar, which is sometimes adulterated with the addition of that acid, to give it the appearance of greater strength.

It ought always to be recollected, that barytes, and all its compounds, are deadly poisons when taken into the stomach.

Sect. IV. *Strontites and its combinations.*

This earth was discovered about the year 1790. It is found native in the state of carbonate in the lead mines of Strontian in Argyleshire in Scotland, from which it derives its name; and also in combination with sulphuric acid in the neighbourhood of Bristol and some other parts of the world.

It may be obtained in a state of purity, by exposing the carbonate of strontites, mixed with charcoal powder, to a strong heat; or by dissolving the native salt in nitric acid, and decomposing the nitrate thus formed by means of heat.

By whatever process it is obtained, it is in the form of small porous fragments, of a greenish white colour; the taste is acrid, hot, and alkaline; it converts vegetable blues to green, and scarcely undergoes any change by a very strong heat. It is not melted under the blow-pipe; but is surrounded with a brilliant white flame. When a little water is added, it is slaked with the evolution of heat, and falls to powder; it is soluble in water, and requires 200 parts of cold water. Boiling water dissolves it more copiously, and when the solution cools it affords transparent crystals in the form of rhomboidal plates, or in flattened silky needles, or compressed prisms. The crystals effloresce in the air, and have an acrid hot taste. The solution of the earth is also acrid and alkaline; converts vegetable blues to green; and when exposed to the air is soon covered with a a pellicle by the absorption of carbonic acid.

This earth has the property of communicating a purple colour to flame. Lime, when subjected to the same test, gives an orange colour, and barytes a yellow colour.

Phosphuret and sulphuret of strontites.—The compounds of strontites with phosphorus and sulphur, are prepared in the same way as similar compounds of barytes, and in many of their properties they are analogous. But when the hydroguretted sulphuret of strontites is decomposed by an acid, the sulphuretted hydrogen gas which is separated holds a portion of the earth in solution, and burns with a beautiful purple flame.

Sulphate of strontites.—If sulphuric acid be added to a solution of strontites in water, a white powder, which is insoluble, falls to the bottom. This is sulphate of strontites, which, as it is found native, is crystallized in the form of fine needles. It is not changed in the air; under the blow-pipe it gives out a yellowish-purple light; and is not decomposed by any of the acids, but by the carbonates of potash and soda, the barytic salts, and by the phosphates of potash, soda, and ammonia.

Nitrate of strontites.—The compound of nitric acid and strontites is prepared by precipitating with nitric acid the sulphuret of strontites, which is obtained from the decomposition of the sulphate, or by dissolving carbonate of strontites in the acid; when the solution is evaporated it crystallizes.

The crystals of this salt are in the form of octohedrons; the taste is cool and pungent; it is not altered in the air; is soluble in 15 parts of cold water, and dissolves more copiously in boiling water, from which it crystallizes on cooling; it decrepitates by sudden heat, and when heated in a crucible is decomposed; oxygen gas and nitrous gas are given out, and the pure earth remains behind. This salt communicates a purple flame to combustible substances, as when it is dissolved in alcohol, or when a little of the salt in powder is thrown on the wick of a candle.

Muriate of strontites.—This salt is prepared by dissolving carbonate of strontites in diluted muriatic acid, and the solution being evaporated, it crystallizes.

Muriate of strontites is in the form of long slender hexagonal prisms; the taste is cooling and pungent; it is not altered by exposure to the air, and is very soluble in water; it is also soluble in alcohol, to which it communicates a purple colour on burning. It melts when heated; is deprived of its water of crystallization, and a semi-transparent enamel remains behind. It is decomposed by sulphuric, nitric, and phosporic acids, and by potash, soda, and barytes.

According to the new opinions of muriatic acid, this salt is a compound of 41 parts of chlorine and 59 of strontium.

Carbonate of strontites.—This salt is found native, and is crystallized in the form of needles, or six-sided prisms. It is prepared artificially, by saturating a solution of strontites in water with carbonic acid, or by precipitating, by means of alkaline carbonates, some of the soluble salts of strontites.

This salt has no taste; it is not changed by exposure to the air, is nearly insoluble in water, and when strongly heated is deprived of part of its carbonic acid. Under the blow-pipe it fuses into an opaque vitreous globule, and gives out a purple flame.

Acetate of strontites.—The compound of acetic acid and strontites is prepared by dissolving the carbonate in the acid; and by evaporation the salt crystallizes. It remains unchanged by exposure to the air; converts vegetable blues to green, from which it would appear that the base is in excess; and is equally soluble in hot and cold water.

Sect. V. *Alumina and its Combinations.*

Alumina is derived from the word alum, of which salt this earth forms a constituent part. Alumina, or pure clay, is one of the most abundant of the earths; it forms a considerable proportion of many soils, and constitutes a very large proportion of the solid strata of the earth.

Pure alumina is prepared, by dissolving a quantity of common alum in water, and adding a solution of potash or of its carbonate, or of liquid ammonia; and the addition of the alkali is to be continued as long as any precipitate is formed. The precipitate being collected at the bottom of the vessel, the liquid part is poured off, and the precipitate being repeatedly washed with a large portion of water, to carry off all soluble matters, is dried in a moderate heat. But if the precipitate retain any portion of sulphuric acid, it may be separated, by adding gradually, and in small quantities, muriatic acid, till the whole is dissolved; the solution is then to be evaporated, till a drop suffered to cool on a plate of glass yields minute crystals. The solution is then set by till it cool, when crystals are deposited, and these crystals being removed, by pouring off the liquid, the evaporation is to be continued, till no more crystals are formed. In this way the alum retained by the earth is separated, and ammonia being added to the remaining liquid as long as any precipitate is formed. The precipitate being collected, well washed, and dried, is pure alumina.

Properties.—Alumina thus prepared, is either in the form of friable fragments, or of fine white powder, soft to the touch, and insipid to the taste. It gives out a peculiar odour, called the earthy smell, when breathed upon or moistened; but this is found to be owing to its contamination with oxide of iron. In consequence of the rapid absorption of moisture, it adheres strongly to the tongue.

Alumina exhibits different appearances, according to the quantity of water employed in the solution of the aluminous salt. If the quantity do not exceed what is necessary for the solution of the salt, a light friable white earth of a spongy appearance, and which adheres to the tongue, is obtained. This is called *spongy* alumina. But when the salt is dissolved in a large quantity of water, the precipitate dried in the same temperature affords a yellowish brittle mass, which splits into small fragments, when held in the hand, like solid sulphur. The fracture is conchoidal; it has no earthy appearance, nor does it adhere to the tongue, or swell up in water; it is much less bulky than in the spongy state, and has some appearance to a dry jelly; and hence it has been called *gelatinous alumina.*

When alumina is exposed to heat, it is diminished in bulk, in consequence of being deprived of the water with which it is combined. On this property of its contraction in bulk depends its application to ascertain high temperatures in the pyrometer of Wedgewood. Under the action of the blow-pipe, with a stream of oxygen gas, it seems to enter into fusion, and is converted into a greenish enamel of such hardness as to cut glass.

Alumina is not soluble in water; but it absorbs and retains a considerable proportion of that liquid; and when it is formed into a paste, it may be easily moulded into any form. With most of the acids, alumina enters into combination, and forms salts, which are more or less soluble, and susceptible of crystallization; but some are insoluble in water, and others require an excess of acid.

The combination of alumina with the earths, and more particularly with lime and silica, forms the chief basis of all kinds of pottery and porcelain, from the coarsest brick to the finest china; and it is chiefly employed in the fabrication of pots or crucibles which are exposed to strong heat, as in the manufacture of glass and cast iron. It has been much employed in cleaning or scouring woollen stuffs; and in consequence of its strong attraction for colouring matter, it is used in dyeing and calico-printing.

Wedgewood's pyrometer.—The pyrometer invented and constructed by Mr Wedgewood, is intended to indicate those high degrees of temperature which the common thermometer cannot reach. It is constructed on the principle of the contraction of pure clay, when it is subjected to strong heat. A pure native clay was selected for this purpose; it was formed into small short cylinders of the same size and length, and being baked in a low red heat to expel the air and moisture, they are prepared for the measurement of strong heats. A scale is formed of two metallic rulers fixed on a plate. The rulers are

Alumina.

24 inches long, divided into 240 equal parts, and the distance between them at the upper extremity of the scale is half an inch, and at the lower extremity only three tenths of an inch. Before the clay cylinder is introduced into the furnace whose heat is to be tried, it is placed between the rulers, and the degree at which it stands is noted; after being heated in the furnace, it is again applied to the scale, and the amount of contraction which it has sustained indicates the temperature. The degrees are reckoned from the top of the scale, or from that degree at which the cylinder stood before being heated.

The first degree of Wedgewood's scale which indicates a red heat, corresponds with 1077° of Fahrenheit's scale, and every degree of the pyrometer includes by calculation 130 degrees of Fahrenheit's scale. The following are some of the corresponding degrees of the two instruments, the comparison of which will render the pyrometer more intelligible.

	Wedgewood.	Fahren.
Red heat, - - - -	0	1077
Fine silver melts - -	28	4717
Fine gold melts - -	32	5237
Welding heat of iron -	95	13427
Cast iron melts - -	130	17977
Greatest heat of an air-furnace, eight inches square -	160	21877
Extremity of the scale, or highest temperature observed -	240	32277

This instrument is fitted to give some information concerning those intense heats which can be measured by no other, and it has been useful in some arts and manufactures where such heats are necessary. But unless the same kind of clay could always be employed, and its treatment in the preparation could always be the same, the contraction of the cylinders can scarcely be expected to be precisely the same, and therefore the estimate formed from them can only be considered as an approximation to the truth.

Test of alumina.—Nitrate of cobalt is a very delicate test of alumina. It may be detected in the hardest bodies, even in the topaz and spinelle, if well pulverized. A drop of the nitrate is placed on the substance to be examined, which is then exposed to the white flame of the blow-pipe. If the mineral contain alumina and not too much iron, it becomes of a blue colour, more or less brilliant and intense, according to the abundance or purity of the alumina.

Sulphate of alumina.—In the preparation of this salt, it is requisite that the acid and earth be in a state of purity, and be saturated with each other. The solution being evaporated to dryness, the dry mass is again dissolved and slowly evaporated, till it crystallize. The crystals are in the form of thin, soft, pliant plates, having a pearly lustre and an astringent taste.

This salt is unaltered in the air, and is very soluble in water; by long calcination it dries and falls into powder, and at a high temperature the acid is driven off.

Sulphate of alumina is soluble in sulphuric acid, and a super-sulphate is formed, which has a more acid taste, and crystallizes with more difficulty, reddens vegetable blues, and often assumes the form of a thick gelatinous mass. Excepting silica and zirconia, all the alkaline and earthy bases decompose both these salts.

Super-sulphate of alumina and potash.—This salt is the *alum* of commerce, which is extensively employed in many arts and manufactures. Before the 15th century, it was imported from Asia into Europe; in the succeeding century, alum-works were erected in Spain and Germany, and towards the end of the 16th century a manufactory was established in Yorkshire, and about a hundred years afterwards similar establishments were made in Scotland. The researches of the chemists of the present day have unfolded the true nature of alum.

The substances from which alum is extracted, are usually strata of argillaceous schistus in which pyrites of iron abound, as the shale of the same character which accompanies coal, and when such materials are exposed to air and moisture a decomposition is effected: the oxygen of the air or of the water when it is resolved into its elements, combines with the sulphur, and forms sulphuric acid, which latter unites with the clay, and forms sulphate of alumina. After various solutions and purifications, potash or ammonia is added to compose the triple salt or alum.

Properties.—Alum usually crystallizes in octohedrons; but, from this form, certain deviations are observed, as when an additional portion of potash is added, the form of the crystal is that of a cube, and hence it is called *cubic alum.* The taste of alum is styptic, and somewhat sweetish. It usually reddens vegetable blues. The specific gravity is 1.7. When long exposed to the air, a slight efflorescence appears on the surface; but otherwise it suffers no change. It is soluble in 16 or 20 parts of cold water; but boiling water takes up a larger proportion. When heated, it melts in its water of crystallization, swells up and enlarges in volume, and a light, porous, dry mass, which more strongly reddens vegetable blues, remains behind. This is called *burnt* or *calcined alum.*

Alum is decomposed by combustible substances. Exposed to a moderate heat with charcoal, the excess of acid is separated, and a neutral sulphate remains; but when it is more strongly heated, the triple salt is decomposed, and the product is a black substance, which spontaneously takes fire in the air, and is called *Homberg's pyrophorus,* from the name of the chemist who discovered it.

Pyrophorus.—This substance is usually prepared by mixing together three parts of alum with one of wheat-flour or sugar in an iron ladle, and exposing the mixture to heat till it becomes black and ceases to swell. It is then reduced to coarse powder, introduced into a coated glass phial, which is to be placed in sand in a crucible, and again subjected to strong heat till a blue flame proceed from the mouth of the phial. Having burnt for a short time, it is taken from the fire, kept excluded from the air, and, when it has cooled, is put into well closed bottles.

When the pyrophorus is exposed to the air, if it be well prepared, it almost instantaneously exhibits a bright glow. The combustion is promoted by breathing on it; and it is still more brilliant in oxygen gas.

Compounds of alumina.

The explanation usually given of the changes that take place in these processes is, that the pyrophorus contains a hydroguretted sulphuret of potash and alumina mixed with charcoal in a state of minute division; and when it comes in contact with the air, the oxygen is absorbed; part is converted into carbonic acid by uniting with the carbone, and part combining with the sulphur forms sulphuric acid; and after the combustion a sulphate of alumina and potash remains, but not in the state of alum, for the excess of acid is dispelled. But the discovery of the composition of potash presents a more satisfactory explanation, according to which the potash is decomposed by the charcoal, and reduced to its metallic base, which by its rapid combination with oxygen produces the light and heat which appear when the pyrophorus is exposed to the air. When the pyrophorus is brought in contact with nitrous gas, it is also inflamed, in consequence of the sudden decomposition of the gas, and the rapid absorption of the oxygen. Similar phenomena are exhibited when pyrophorus is immersed in chlorine gas, by its strong affinity for potassium, and its sudden combination with that metallic base.

Alum is very extensively employed in many of the arts, as in bleaching, tanning, dyeing, calico-printing, and some others; it is applied to the purposes of medicine as an astringent and styptic; and it is sometimes used in preserving animal matters from putrefaction.

Sulphate of alumina and potash.—This neutral triple salt is prepared, by boiling a solution of pure alumina with a solution of crystallized alum, by which the excess of acid is taken up, and the new compound falls to the bottom in the state of a white powder. This salt assumes no regular form, has no taste, is not changed by the action of the air, and is not soluble in water.

Sulphite of alumina.—If a current of sulphurous acid gas be passed into water, holding pure alumina suspended in it, the sulphite in the state of a white soft powder is formed. This salt has an earthy taste, which becomes afterwards sulphureous, is converted into the sulphate of alumina by long exposure to the air, and is insoluble in water.

Nitrate of alumina.—This compound, formerly called *nitre of argil*, and *nitrous alum*, is prepared by the direct combination of nitric acid with alumina. It can scarcely be crystallized, excepting in thin plates, and it often remains a gelatinous mass. This salt has an austere and acid taste, is deliquescent in the air, and very soluble in water.

Super-muriate of alumina.—This compound is formed by combining the acid with the earth, and the acid is always in excess. It is usually in the form of white powder, or of a gelatinous mass, and very rarely crystallized; has an astringent acid taste; reddens the tincture of turnsole and of violets; is very deliquescent, and very soluble in water; it melts with heat, and is decomposed, the acid is expelled, and the pure earth remains behind.

Alumina enters into combination with most of the other acids; but these compounds are either of no great importance, or are little known.

Sect. VI. *Silica and its Combinations.*

Silica.

Silica has sometimes been denominated *siliceous* earth, or quartzy earth, because it is obtained from silex, or flint, and from the stone called quartz. It is very abundant in nature, and forms the base of some of the hardest stones. Few stony bodies are entirely destitute of some portion of silica; and some of them, as the agate, flint, quartz, and rock-crystal, are almost entirely composed of it. In rock-crystal it is nearly in a state of purity.

To obtain silica perfectly pure, a piece of quartz, or rock-crystal, after being subjected to a red heat, and while it is yet hot, is to be suddenly immersed in cold water. By this treatment it is easily reduced to powder, of which one part, mixed with three parts of potash, is to be exposed in a crucible to heat sufficient to fuse the mixture. This mass is soluble in water; and after it is sufficiently diluted, drop in muriatic acid as long as any precipitate is formed; wash the precipitate repeatedly with water, and let it be dried. The substance thus prepared is pure silica.

Properties.—Silica is in the state of a fine white powder, without taste or smell; the particles feel rough and harsh to the touch; the specific gravity is 2.6. It is insoluble in water; but when minutely divided, it absorbs a considerable portion, and forms with that liquid a transparent jelly. When exposed to the air, the whole of the moisture evaporates. Silica is often found in nature crystallized, under the name of *rock-crystal*. The crystals are in the form of six-sided prisms, terminated by six-sided pyramids. Crystals of silica, it is said, have been also obtained by artificial processes, as from a solution of the earth in fluoric acid, and in another case from the soluble compound of silica and potash which had remained at rest for several years. In the first case, the crystals were in the form of cubes, some of which had truncated angles; and in the second they were in the form of four-sided pyramids, perfectly transparent, and so hard as to strike fire with steel. But may it not be doubted whether these crystals, even with their transparency and hardness, were really composed of pure silica?

Few of the acids have any action on silica. Phosphoric and boracic acid combine with it by fusion; fluoric acid dissolves it either in the state of liquid or elastic fluid; and muriatic acid seems to unite with it, when it is held in solution in water by means of an alkali.

The alkalies have a powerful effect on silica. The compound has very different properties, according to the proportion of the silica and the alkali. With two or three parts of potash and one of alkali, a mass is formed, which is deliquescent in the air, and soluble in water. This compound has been denominated *liquor of flints*, and *silicated alkali*. This solution being long exposed to the air, deposits the earth in a flaky gelatinous form; it is decomposed by acids, which combine with the alkali, and the pure earth is precipitated; and when it is largely diluted with water, and a greater proportion of muriatic acid than what is sufficient to saturate

Yttria.

the alkali, part of the earth seems to be dissolved. When the proportion of silica is greater, the silica and the alkali unite by fusion, and the compound thus formed, which is glass, possesses very different properties; it is not changed in the air; is insoluble in water; and is acted on by none of the acids, excepting the fluoric.

Silica also unites with some of the earths; and the compounds thus formed are either of the nature of glass or porcelain, or are possessed of some intermediate properties. The most important of these compounds is that of silica and alumina, which being formed into a paste with water, and subjected to strong heat, acquires a considerable degree of hardness. This compound forms the basis of the different kinds of pottery and porcelain.

In some later chemical speculations, silica is considered as an acid, because it is different in its properties from the other earths, does not enter into combination with acids, and at the same time forms compounds with alkalis and earths. To those who have been accustomed to the former views of the nature of this substance, its arrangement among the acids will appear a considerable stretch of theory; and at the same time it may be questioned whether, in its peculiar character, it be not as far removed from the acids as from the earths.

By adding muriatic acid to a solution of silicated potash, part of the silica unites with the acid, and remains in the solution, which is quite transparent, always acid, and when concentrated assumes the form of a transparent jelly. By boiling, the silica is precipitated in small crystalline particles. Fluoric acid, either in the gaseous or liquid form, unites with silica, and hence it happens that glass vessels are corroded when fluoric acid is prepared in them. When the gas, in combination with silica, is condensed by water, part of the earth is precipitated, but is again dissolved by a new addition of the acid. A triple salt is formed with fluoric acid and potash and silica, and with soda and silica; boracic acid, by means of strong heat, yields a transparent glass, which is insoluble in water; and the phosphate of silica is a hard transparent glass which is employed in the fabrication of artificial gems.

Sect. VII. *Yttria and its Compounds.*

The mineral from which yttria is extracted was discovered in 1794, at Ytterby, a place in Sweden. Nearly one half of the mineral consists of the new earth, and the other constituent parts are silica, iron, and alumina. The mineral being reduced to powder, nitro-muriatic acid is added till the whole is decomposed, and the solution being filtered, evaporated to dryness, and diluted with water, the silica remains behind. The filtered liquid being also evaporated to dryness, the residue is exposed to a red heat in a close vessel, and being dissolved in water, a transparent and colourless liquid is obtained. By the addition of a solution of ammonia, a precipitate is formed, which is the pure earth of yttria.

Properties.—The earth of yttria is in the form of a white powder, without taste or smell, is infusible by heat, and insoluble in water or in any of the caustic fixed alkalies, but it readily dissolves in carbonate of ammonia. The specific gravity is 4.8.

Glucina.

Yttria forms compounds with most of the acids; the salts have a sweetish austere taste, some of them are of a reddish colour, and most of them are soluble in water.

Sect. VIII. *Glucina and its Compounds.*

The earth of glucina, which is one of the constituent parts of the beryl or emerald, was discovered in 1798, and received this name from the sweet taste of its salts. One hundred parts of the mineral being reduced to fine powder, are fused with 300 parts of caustic potash, and the fused mass being diluted with distilled water, is to be dissolved in muriatic acid. The solution is then evaporated to dryness, stirring it towards the end of the evaporation, and the residue being diluted with a large quantity of water and filtered, the silica is separated. The filtered solution, containing the muriates of alumina, and glucina, is precipitated by carbonate of potash; and the precipitate being well washed, is dissolved in sulphuric acid. Add to this solution sulphate of potash, and evaporate to obtain crystallised alum; and after it yields no more alum by the addition of the sulphate of potash, add a solution of carbonate of ammonia in excess, and stir the mixture well. The glucina, after being deposited, is dissolved by means of the excess of the ammonia, and the small quantity of alumina remaining is precipitated without being dissolved. At the end of a few hours, when the aluminous precipitate is not diminished in volume by a new addition of carbonate of ammonia, the solution being filtered, is boiled, and as the carbonate evaporates, the carbonate of glucina is precipitated in the form of a white gritty powder. The carbonic acid is driven off by heat.

Properties.—Glucina obtained by this process is either in the form of a soft powder, or light white fragments. It adheres to the tongue, but is insipid to the taste; the specific gravity is 2.9.; it is infusible by heat, and insoluble in water; but forms a paste which has less tenacity than that of alumina. It combines with sulphuretted hydrogen, when a current of gas is brought in contact with the earth, diffused in water, and forms a hydrosulphuret.

The characteristic properties of glucina are the following: Its compounds with the acids are sweetish and slightly astringent; it is soluble in sulphuric acid when a little in excess; it decomposes aluminous salts by separating the earth when it is boiled in their solutions; the salts of glucina are completely precipitated by ammonia; it is soluble in the liquid carbonate of ammonia; and its affinity for the acids is between magnesia and alumina.

Sect. IX. *Zirconia and its Compounds.*

Zircon or jargon, a mineral production of the island of Ceylon, and which has been also found in France and Britain, gives name to the earth called Zirconia. The earth is extracted by reducing a quantity of the mineral to fine powder, and after fusing it with five or six times its weight of pure potash, dissolve the mass in water, to separate the alkali, and then dissolving the residue in muriatic acid, which being heated, the silica is separated; and when it appears that no farther precipitate is produced, a caustic fixed alkali throws down a quantity of matter, which, being well washed and dried, is found to be pure zirconia.

Properties.—Zirconia is in the form of fine white powder, soft to the touch, without taste or smell, is insoluble in water, but retains a quantity, and forms with it a transparent jelly. The specific gravity is 4.3. It is infusible under the blow-pipe, but gives out a yellowish light. Heated with charcoal, it undergoes a kind of fusion, but is not transparent or vitreous, and becomes so hard that it scratches glass, and strikes fire with steel. When subjected to a red heat it assumes a grey colour, is harsh to the feel, and less soluble in acids.

Zirconia may be dissolved by the akaline carbonates, but is insoluble in liquid alkalies, and does not combine with the alkalies by fusion.

Zirconia combines with the acids, and forms with them peculiar salts, most of which are insoluble in water; are usually in the form of a white powder, and have an astringent taste, contrary to most other compounds of the acids with the earths; the vegetable acids have the strongest affinity for zirconia, after which follow sulphuric, muriatic, and nitric acids, in the order now enumerated.

Chap. XIII. Of Metals.

Metals are of great importance in civilized life; and indeed the origin and improvement of many of the most useful arts are in some degree coeval with the knowledge of metallic substances.

Metals are distinguished from the other objects of chemical investigation by many characteristic properties. One of the most obvious of these properties is lustre or brilliancy, which is so striking that it is denominated *metallic lustre.* Colour is another property of metallic substances; white is the prevailing colour of most metals, but some are yellow, and others are reddish. In the nomenclature of the alchemists, metals of a white colour were called *lunar* metals, because silver was named *luna*, and from its more perfect whiteness was placed at their head. Gold was called *sol*, and held the first place among metals of a yellow colour, and hence their appellation of *solar* metals.

The opacity of the metals is another characteristic property. They possess a greater degree of density than other substances; some of them are remarkable for their hardness, and their elasticity seems to follow in the same order as their hardness Ductility and malleability, or the property of being drawn out into wire, or of being hammered into different forms, or into thin leaves, are characteristic qualities of the metals. But these properties are not united in the same metal, for iron is one of the most ductile, while it less malleable than other metals. Metals possess tenacity in a higher degree than other substances, but differ much among themselves in this property. Fusibility is another property of the metals. With a sufficient degree of heat they are reduced to the state of liquid; some of them are fused with a moderate heat, others require the highest temperature; and mercury, in the ordinary state of the atmosphere, is always fluid. Metallic substances, while they vary among themselves in this property, are the best conductors of caloric and electricity.

In certain circumstances, metals undergo a very remarkable change, when they unite with oxygen. This process is called oxidation, and the product, which is often in the form of powder, is called an oxide. Some metals undergo this change in the ordinary temperature of the atmosphere. Iron exposed to the air is soon deprived of its metallic lustre, and is covered with a brownish powder, known in familiar language by the name of *rust*. To effect this change in other metals, they must be subjected to a great degree of heat.

Different metallic substances combine with very different proportions of oxygen, and even the same metal combines with different proportions, and exhibits very different properties; but they are all in the form of powder, or so brittle as to be easily reduced to that state; they are of all colours, and are heavier than the metals from which they are obtained. In some cases the affinity between the oxygen and the metal is so slight that a separation takes place when they are exposed to the air and light; but in others the strongest heat is necessary, with the addition of a combustible substance which has a stronger affinity for the oxygen, while others still become fusible, and are converted into a vitreous matter.

The remarkable change which was observed to take place on metals by the action of air and heat, has given origin to different theories of chemistry. According to the phlogistic theory, metals are composed of earth and phlogiston, and the process of calcination is nothing more than the separation of the phlogiston from the metal, while the earth remained behind. The objection to this doctrine, that the product had become heavier even after it had been deprived of something, was obviated by supposing that phlogiston, or the principle of inflammability, diminished the specific gravity of substances with which it is combined, or that it possessed a principle of levity. But the more accurate experiments of modern chemists have fully established the fact, that metals, during the process of calcination, combine with oxygen.

Metallic substances enter into combination with carbone, phosphorus, and sulphur, forming carburets, phosphurets, and sulphurets; the oxides of the metals unite with most of the acids, and afford salts, some of which are of great importance, not only in chemistry, but also in many arts; and they combine with each other, forming a class of bodies which are denominated *alloys*.

The metals were formerly divided into noble, or perfect and imperfect; and according to another division, into metals and semi-metals, as they possessed more or less of the properties of malleability and ductility. In later arrangements they have been divided according to their degrees of brittleness or ductility, or as they are more or less easily oxidated. But these arrangements, even if they could be perfectly defined, seem not to be of much importance; but they are not always correct, for, by particular treatment, metals accounted brittle and imperfect, may become malleable and perfect, as in the case of zinc, which being rolled or hammered at a certain temperature, acquires and retains the properties of ductility and malleability in a considerable degree.

The names and characters assigned to the metals by the alchemists were interwoven with ancient mythology, and as the rage of alchemy prevailed during the period in which judicial astrology flourished, a close connection was formed, and long existed between these imaginary pursuits. See a curious dissertation on this subject by Professor Beckmann *History of Inventions*, III. 55.

Sect. I. *Gold and its Combinations.*

The scarcity, durability, and beauty of gold, have ranked it high in the estimation of mankind from the earliest ages of the world. Regarded by the alchemists as the simplest, the purest, the most perfect, and, as it really is, the most indestructible of all the metals which were known to them, it was placed at the head of the noblest and most perfect, and was dignified with the pompous appellation of *king of the metals*. Gold is supposed to be, next to iron, the most universally diffused of all the metals; but at the same time it is one of the scarcest, because it is found in such small quantities. Few parts of the world are altogether destitute of gold in the state of small grains, mixed with sand or soril. But it seems to be most abundant within the torrid zone, where it constitutes a valuable commercial commodity, under the name of gold dust. It is also met with embedded in stones, especially quartz, and either in grains or crystals, or in an arborescent or laminated form, in their fissures. Gold, as it exists in nature, is always in the metallic state; but it is generally alloyed with other metals, as with silver or copper, iron, or mercury.

To separate gold from its alloys it is to be dissolved in nitro-muriatic acid, and as the muriate of silver is insoluble, it falls down. The gold itself may be precipitated by sulphate of iron, and the quantity of iron may be ascertained by a prussiate of potash. If the liquid hold any copper in solution it may be precipitated by means of iron. Each of these processes is performed on different portions of native gold; and in this way the quantity of gold, and of the other metals with which it is alloyed, may be ascertained.

In the extraction of gold in the large way, the auriferous sand of rivers is washed to separate extraneous matters; it is then introduced into a vessel with water, and triturated with ten or twelve times its weight of mercury. The water being poured off, carries with it the remaining earthy matters, and the amalgam of gold and mercury being pressed in skins to separate the excess of mercury, the remaining solid part is subjected to heat in stoneware retorts, to drive off the whole of the mercury.

Cupellation.—But to separate the gold from the other metals it must undergo the process of *cupellation*. In this process a small flat cup, made of the powder of burnt bones, and called a *cupel*, is employed. The gold is included in a plate of lead, usually double the weight of the gold, the cupel is put under a muffle in the middle of the furnace, for the purpose of increasing the heat and keeping off the fuel from the fused matter; heat is applied, and the lead is oxidated and vitrified. In this state the lead unites with all the other metals, except the gold, sinks into the porous cupel, and leaves the gold in a state of purity.

Properties.—The colour of gold is reddish yellow, the lustre is considerable, although inferior to that of some other metals; the specific gravity is 19.3 and 19.4, and it is extremely ductile and malleable. A single grain may be beaten out so as to cover nearly 57 square inches, and the coating of gold which covers wire is still thinner. An ounce of gold, on silver wire, may be extended more than 1300 miles in length. The tenacity of gold is inferior to that of silver, copper, or iron. It is not changed by exposure to the air; and it melts at 32° of Wedgewood's pyrometer, or at 1300° of Fahrenheit; it crystallizes after fusion.

Gold remains unaltered in the strongest heat of a furnace, but when it is subjected to the action of a powerful burning glass, or of electricity, it assumes a purple colour, which is a compound of the gold and oxygen. A similar effect is produced on gold when the gilding in the inside of a house is struck with lightning. This compound is called the purple oxide from its colour, and it contains about five or six parts of oxygen in the hundred. But when eight or ten parts of oxygen unite with the gold, a yellow oxide is obtained. This oxide may be precipitated by lime water from the solution of gold in nitro-muriatic acid.

Phosphuret.—If a mixture of one part of gold-filings with two parts of phosphoric glass, and one-eighth part of charcoal, be heated together in a crucible, part of the phosphorus unites with the gold, renders it whiter and more brittle, and gives it something of the appearance of crystallization. If kept some time in fusion it is decomposed, and the phosphorus is expelled in the state of vapour.

Nitrate of gold.—If concentrated nitric acid be several times successively poured upon gold, boiled and distilled to dryness, a solution of a yellow colour is obtained, and with more facility if the acid be impregnated with nitrous gas. As the action of the acid on the gold proceeds, the former is deprived of its colour, and the solution is more speedily completed in the cold than with heat, because the nitrous gas is driven off. When this solution is filtered, it leaves a violet-coloured trace, which is the purple oxide on the paper; it is also decomposed by the alkalies, or by introducing a plate of tin or silver into the solution, when the purple oxide is precipated in the form of powder.

Muriate of gold.—Muriatic acid has no effect whatever, either on gold or its purple oxide; but gold is immediately dissolved in nitro-muriatic acid. The nitric acid is decomposed, and furnishes the oxygen, and the oxide is then dissolved in the muriatic acid forming the muriate of gold.

This solution is of a deep yellow colour, is very acrid and caustic, has an astringent metallic taste, and stains the skin, as well as vegetable and mineral substances, of a deep purple colour. By evaporation, crystals in the form of truncated octohedrons are obtained. This salt is deliquescent, and soon becomes liquid; it is very soluble in water, and is readily decomposed by hydrogen gas, by phosphorus, sulphuretted and phosphuretted hydrogen gases, and sulphurous acid.

Exper. 1. Moisten a piece of clean silk ribbon with a solution of muriate of gold, and expose it to the action of hydrogen gas; the salt is decomposed, and the gold being reduced to the metallic state, forms a gilt covering on the silk; the hydrogen having a stronger affinity than the gold for the oxygen, combines with it and forms water. This experiment may be varied by drawing figures with a pencil on the silk.

Exper. 2.—Introduce a stick of phosphorus into a saturated solution of muriate of gold, a decomposition of the salt takes place, and the phosphorus is covered with metallic gold. Similar decompositions are produced by burning sulphur, and by exposing the solution to the action of the other gases already alluded to. These curious experiments were first made by Mrs Fulhame, and they are particularly detailed in her *Treatise on Combustion*.

The muriate of gold is soluble in ether. When ether is added to a solution of gold, and the mixture is agitated, the two liquids separate; when they are left at rest the acid falls to the bottom, and becomes white, and the ether rises to the top, and assumes a golden yellow colour. But this solution is not permanent, the gold is soon reduced to the metallic state, and is sometimes found crystallized on the surface. By this process, what was formerly called *potable* gold, was prepared; and by a process somewhat similar, it has been alleged, Moses dissolved the golden calf, which was the idolatrous object of worship among the Israelites.

The muriate of gold is decomposed by the alkalies and earths, and is reduced to the state of yellow oxide. With the fixed alkalies the decomposition proceeds slowly, and if a sufficient quantity of the alkali be added, the precipitate is redissolved, the liquid becomes of a reddish colour, and a triple salt is supposed to be formed.

Fulminating gold.—This singular compound is prepared by adding gradually a solution of pure ammonia to a solution of muriate of gold, diluted with three or four times its weight of water, as long as any precipitate is formed. The precaution must be observed of adding no more alkali than what is necessary, because the precipitate is re-dissolved. The precipitate is then to be washed, dried on paper in the open air, and put into a phial which is to be covered with a bit of paper or cloth, because the slightest friction of a stopper or cork produces explosion. The same fulminating powder is prepared by dissolving gold in a solution of two parts of nitrate of ammonia and one of muriatic acid. During this solution the nitric acid is decomposed, the oxygen combines with the gold, the nitrous gas is separated, and muriate of gold and muriate of ammonia remain in the liquid. By the addition of a fixed alkali the muriatic acid is separated from the gold and the ammonia, and the oxide combining with the ammonia, forms the fulminating powder.

This powder detonates with great violence by means of heat, friction, or percussion. The hydrogen of the ammonia unites with the oxygen of the gold and forms water, and this water being suddenly raised to the state of vapour, and the azote, the other constituent element of the ammonia, being converted into gas, produce the explosion, while the gold is revived, or restored to the metallic state.

Some of the metals produce a total decomposition of the muriate of gold, and reduce it to the metallic state, while others deprive it of part of its oxygen, and bring it to the state of purple oxide. Bismuth, zinc, iron, copper, and mercury, reduce it entirely; but lead, silver, and tin, occasion a precipitate in the form of purple oxide. If a solution of muriate of gold be added to a solution of muriate of tin, recently prepared, and largely diluted with water, a precipitate is formed of a purple colour, and is hence denominated *purple precipitate*, or *powder of Cassius*. The same effect is produced by immersing a plate of tin, or a piece of tinfoil, in the muriatic solution of gold. The metallic tin is soon covered with a thin layer of the purple oxide.

Alloys.—Gold combines with most of the other metals, and has its properties very considerably changed. The compounds of the metals with each other, are distinguished by the name of alloys. The alloy of gold with arsenic is brittle, hard, of a granulated texture, and of a pale colour; with cobalt it is not perceptibly different from the cobalt itself; and the alloy of antimony and gold in equal proportions, approaches nearly in appearance to gold itself, and hence it was supposed by the alchemists that the quantity of gold was increased in this compound, and from its seeming power of dissolving gold, antimony was called the *royal bath*. Gold unites readily with mercury, even in the cold. If gold be brought into contact with mercury it is instantly covered with it, in consequence of the strong affinity between the two metals. Gold-leaf triturated with mercury, totally disappears, and the amalgam, which is the name applied to the compounds of mercury with the other metals, is of a yellowish white colour, fusible at a moderate temperature, and decomposed by a strong heat, in consequence of the dissipation of the mercury. This amalgam is extensively employed in the operation of gilding. The alloy of gold with zinc, which is effected by means of fusion, is paler than gold, has little malleability, when in equal proportions is very hard, and susceptible of a fine polish, and with these properties has been recommended in the fabrication of mirrors for telescopes. The alloy of gold with tin is very brittle, and it was supposed that even the vapours of tin deprived gold of its ductility. But later experiments have shewn, that the supposed injurious effects of tin are to be ascribed to other metals, as bismuth, lead, antimony, or zinc, with which the tin happens to be contaminated. Lead combined with gold deprives the latter of its ductility, and diminishes the colour; and the alloy of gold and iron affords a hard brittle mass, which, in certain proportions of the two metals, is so hard that it is fit for cutting instruments. The alloy of silver and gold, in the proportion of one-twentieth of the former, produces a perceptible change in the colour of the gold, and being more fusible is employed for soldering gold.

Gold coin.—The most important alloy of gold is with copper, which, as it communicates hardness to the gold without diminishing its colour, is employed as the gold coin of most countries. The proportions of the gold coin of Britain and France are eleven parts of gold and one of copper. According to some experiments, the specific gravity of the compound was found to be greater than the mean; from which it is inferred that a mutual penetration in the alloy produced an increase of density. But according to Mr Hatchett's elaborate experiments detailed in the *Philosophical Transactions* for 1803, some degree of expansion was observed. In large masses of the alloy the two metals are unequally diffused, which is also found to vary with the form, nature, and position of the mould in which the compound is cast, and produces variations in the specific gravity. In one experiment the bulk of the two metals before combination was 27.32; but after fusion the bulk of the compound amounted to 27.98, thus shewing an increase of expansion; and the specific gravity of the alloy was found to be 17.157. One part of copper and seven parts of gold afford an alloy, which, being more fusible than gold, is employed as a solder for that metal.

Sect. II. *Platina and its Combinations.*

Platina, signifying little silver, is derived from the Spanish word *plata*, which denotes silver, was first shewn to be a distinct metal by the experiments of different chemists, but particularly those of Lewis and Scheffer, and afterwards of Margraaf, Macquer, and Beaume. The experiments alluded to were made between the years 1749 and 1758.

Platina was first found among the gold ores of South America, and especially in the mine of Santa Fe, near Carthagena, and in the district of Choco, in Peru, and it was supposed to be an exclusive production of the New World, till it was detected by Vauquelin in some of the ores from the silver mines of Guadalcanal, in Spain. It is found in the form of small grains, or scales, of a white or greyish colour, and these grains are not only intermixed with particles of gold, of mercury, and a black ferruginous sand, which have been long observed, but the more accurate researches have detected four other metals with which the platina is alloyed.

For the preparation of pure platina the grains are to be dissolved in concentrated nitro-muriatic acid, and with the application of a very moderate heat. A black matter is deposited, on which the acid has no effect. To the decanted solution add a solution of sal ammoniac, which throws down an orange-yellow coloured precipitate. This precipitate being washed, dried, and subjected to heat, gradually increased to redness in a porcelain crucible, platina is obtained nearly pure in the state of powder, but it may be brought to still greater purity by a repetition of the process; and, as platina possesses the property of welding, if the grains be wrapt up in a thin plate of the same metal, heated to redness, and cautiously hammered, they may be united into a mass.

Properties.—Platina is of a white colour, but is inferior in brilliancy to silver or gold, has neither taste nor smell, is next to iron in hardness, and the specific gravity, which is 21.4, when it is precipitated from its solution, is increased by hammering to 21.5. It has great tenacity, and possesses the properties of ductility and malleability in a high degree. Platina is not changed by exposure to the air. When heated to whiteness it may be welded by hammering, like iron, but it is infusible in the strongest heat of a furnace. By means of the blow-pipe, and with a stream of oxygen gas, small particles have been melted. But with a current of oxygen and hydrogen gases a larger mass may be fused.

Oxides.—Platina appears to combine with two proportions of oxygen; the first, or the black oxide, contains nearly five parts of oxygen in the hundred, and it may be prepared by adding a neutral solution of muriate of mercury to a diluted solution of muriate of platina in hot water. A powder of a brownish or yellowish colour, which is a mixture of calomel and the black oxide of platina, is precipitated, which, being washed and dried, and subjected to a heat which is just sufficient to expel the calomel, a black powder remains behind. The grey oxide, which is supposed to contain three times the quantity of oxygen, combines with the acids to form salts.

Phosphuret, &c.—Platina enters into combination with phosphorus, and two compounds are obtained, in one of which the proportion of phosphorus is double of what it is in the other, and with sulphur it forms three distinct compounds.

Sulphate of Platina.—If a current of sulphuretted hydrogen gas be passed through a solution of muriate of platina, a precipitate of a very dark brown colour is formed. This substance has an acid and metallic taste, deliquesces in the air, and is very soluble in water. With the fixed alkalies, as with potash and soda, triple salts are formed. No precipitate is produced with sal ammoniac; but if the solution be evaporated to dryness, a muriate of ammonia and platina is obtained. A similar compound is produced, by adding a solution of muriate of barytes, or of muriate of alumina, to a solution of sulphate of platina; in the first case, sulphate of barytes and platina, which is in the form of a brown precipitate, and, in the second, a gelatinous precipitate, which, being dried, is in the form of a black shining powder, is produced. Both of these triple salts are insoluble in water.

Muriate of platina.—Platina being dissolved in nitro-muriatic acid forms a solution of a reddish, or deep brown colour, which is extremely acrid and caustic, corrodes animal matters, and leaves a brown spot on the skin. The solution being concentrated, deposits, on cooling, small regular crystals, which are not very soluble in water. The solution is of a yellow colour. When strongly heated, the salt is decomposed, and the acid is driven off. It is partially soluble in boiling muriatic acid, but it is insoluble in sulphuric, nitric, or phosphoric acids. According to the new doctrines of the constitution of muriatic acid, this salt is considered as a compound of chlorine and platina, and therefore it is a chloride of platina.

When the muriate of platina is precipitated by means of the alkalies, triple salts are obtained; the muriate of platina and soda crystallizes, and is soluble in water and alcohol; the muriate of platina and

Palladium. potash crystallizes in the form of octohedrons, of a yellow colour.

Fulminating platina.—If the muriate of platina and ammonia be precipitated by means of potash, a fulminating powder, which is supposed to be a compound of oxide of platina and ammonia, is obtained. When this substance is subjected to sudden heat it decrepitates, but when the heat is gradually applied a violent detonation is produced. This explosive substance is announced as a new discovery, although it is described in the *Annales de Chimie*. 49. 179. many years ago. The method of preparing it is different. The muriate of platina is precipitated by sulphuretted hydrogen, and the precipitate is dissolved in sulphuric acid; the sulphate is precipitated from its solution in water by ammonia, and the latter precipitate, after being washed, is boiled with a solution of potash. It is then filtered, washed, and dried; the dry powder is the fulminating platina. It requires a temperature of 400° for its detonation, but it does not explode by friction or percussion. It is found to be a compound of oxide of platina, with nearly an eighth-part of ammonia, and the same proportion of water.

Alloys.—Platina enters into combination with many of the metals. The alloy with arsenic is brittle, and very fusible. From this latter property the platina may be formed into different utensils and instruments. By heating and hammering, the arsenic is driven off, and the platina is purified, and becomes infusible, while it retains its ductility. The alloy with antimony is very brittle, but considerable difficulty is found in combining it with mercury. The compound of zinc and platina affords a fusible, brittle, and hard alloy; but the most fusible of all the alloys of platina is with tin, and when the metals are in equal proportions it is hard and brittle. Platina readily combines with lead, but the refractory nature of platina has precluded the process of cupellation for its purification, as it is employed for gold and silver. Platina and iron, in the state of alloy, are found native; and an artificial alloy of great hardness, and with some degree of ductility, has been obtained by fusing together platina and cast iron. Copper alloyed with platina acquires greater hardness, and silver, while it increases the hardness of the latter, diminishes its whiteness. Gold and platina require a powerful heat for their combination, and the colour of the gold is diminished.

The density, infusibility, and indestructible nature of platina are too valuable properties not to render it one of the most useful metals yet known, if it could be procured in greater quantity, and at a more moderate price. But on account of its scarcity its utility has been hitherto limited to chemical purposes; and it is found peculiarly appropriate for chemical instruments and utensils, as it is capable of resisting the effects of most chemical agents. It seems probable, too, that its use might be extended in the construction of instruments and utensils in various arts and manufactures.

Sect. III. *Palladium and its Combinations.*

Palladium, which is one of the metals detected in the ore of platina, was discovered by Dr Wollaston in 1803. When crude platina is dissolved in nitro-muriatic acid, and prussiate of mercury is added to the solution, it becomes first muddy, and a yellowish white matter is afterwards precipitated. The precipitate being washed and dried, and then subjected to strong heat, leaves a white matter behind, which being heated with sulphur and borax, is converted into a metallic button susceptible of hammering or rolling. Rhodium.

Properties.—In its colour and appearance palladium approaches nearly to platina; it is harder than iron; its specific gravity varies from 11.3 to 12.14, and it is not inferior to platina in malleability, but has little elasticity. It remains unchanged in the air, and acquires a powerful heat for its fusion, but on redhot charcoal, with a stream of oxygen gas, it is burnt and partially dissipated, and when strongly heated the surface becomes blue from insipient oxidation, and has its colour restored by raising the temperature. An oxide has been formed by heating together filings of palladium with caustic potash and nitre, in a crucible of platina. This oxide is of a brownish colour, and is easily soluble in muriatic acid. Palladium combines readily with sulphur, and the compound is very fusible, brittle, and diminished in colour.

Salts.—Sulphate of palladium is prepared by boiling sulphuric acid with the metal, and the solution assumes a fine red colour. Palladium is slowly acted on by concentrated nitric acid: the liquid becomes also red; but during the process it is singular that no nitrous gas is given out. When the acid is impregnated with nitrous gas, the process advances with greater rapidity. With the aid of heat, muriatic acid acts slowly upon palladium; the liquid also assumes a red colour, but nitro-muriatic acid dissolves this metal with great facility, and furnishes a solution of a more brilliant red. Triple salts are obtained from muriatic acid, palladium, and each of the three alkalies, and these saline compounds are susceptible of crystallization. When prussiate of mercury is added to the solution of palladium in nitric acid, the precipitate formed has an explosive property, approaching nearly to the strength of gunpowder.

Sect. IV. *Rhodium and its Combinations.*

Rhodium was also discovered by Dr Wollaston, in crude platina, in the year 1804. To extract it from the crude ore, the platina is subjected to a red heat to drive off the mercury; and the gold and some other substances are separated by digestion, in a moderate heat, in a small portion of diluted nitro-muriatic acid. A shining black powder remains after the other substances are dissolved, from which the solution being separated, a solution of sal-ammoniac in hot water is added, and the greater part of the platina is precipitated in the state of a yellow powder. A plate of zinc immersed in the solution, throws down a black powder, which being washed and treated with diluted nitric acid in a moderate heat, is freed from copper and lead. Being again washed and digested in diluted nitro-muriatic acid, the greater part is dissolved, and common salt being added to the solution, the whole is evaporated to dryness; and the residue being repeatedly washed with small portions of alcohol till it come off nearly colourless, the oxides of platina and palladium are obtained in combination with the common salt; and the oxide of rhodium also in combination with the common salt, and of a deep red colour, remains behind. This matter, dissolved in water, affords, by slow evaporation, crystals of a deep red colour; the crystals being re-dissolved in water, and a plate of zinc immersed in the solution, a black powder is precipitated; and this powder being subjected to strong heat with borax, assumes a metallic appearance. This metal is rhodium.

In colour it nearly resembles platina; it is brittle, and as hard as iron; the specific gravity is 10.6; it is almost infusible, and it possesses the singular property of being insoluble in all the acids.

Rhodium unites with oxygen in two different proportions, so that two oxides are obtained; and the solution of the oxide of rhodium in sulphuric, nitric, and muriatic acids, is of a red colour. Muriatic acid, with soda and rhodium, forms a triple salt, which affords crystals of a deep red colour, and which are soluble in water.

Sect. V. *Iridium and its Combinations.*

Iridium was discovered by Mr Tennant in 1803, and by M. Descotills about the same time. The black powder which remains after the solution of crude platina in diluted nitro-muriatic acid, is in the form of small shining scales, and contains two metals in combination, namely, iridium and osmium. It was afterwards observed, that the flat white foliated grains in the crude ore of platina, are a compound of the same two metals.

The two metals are separated by heating the black powder to redness, with an equal weight of potash, in a silver crucible; water being added, a solution of a deep orange colour is formed, and part of the powder remains undissolved. This portion being digested in muriatic acid, assumes various colours, from blue to olive, green, and deep red. That part of the powder which is not acted on is to be alternately treated with potash and muriatic acid, till a complete dissolution is effected. In this way two solutions are formed. In the alkaline solution, which is of a deep orange colour, the potash is united to the oxide of osmium, and in the acid solution, which is of a deep red, the muriatic acid is in combination with the oxide of iridium.

By evaporating the latter solution to dryness, redissolving the residue in water, and by a second evaporation the salt crystallizes, and the crystals being dissolved in water give a deep red solution; and by immersing a plate of zinc or iron, a black powder is precipitated, which being heated exhibits a metallic lustre, and is pure iridium, a name expressive of the diversity of colours in the solutions of this metal.

Iridium is nearly as infusible as platina; it is almost equally insoluble in acids; the specific gravity is supposed not to be less than 18.6; it seems to combine with oxygen in two proportions; and the only saline compound of this metal which has been examined is the muriate already noticed.

Sect. VI. *Osmium and its Combinations.*

Osmium is one of the metallic substances which has been detected by modern chemists in crude platina. It was discovered by Mr Tennant; and the method of separating it from iridium has been already noticed in the preceding section which treats of that metal. The peculiar smell of the alkaline solution of the oxide of osmium, which is somewhat similar to the odour of oxymuriatic acid, suggested the name of osmium.

The oxide of osmium may be separated from the alkaline solution, by adding sulphuric acid, and distilling the mixture with a moderate heat. The colourless liquid which comes over, and which consists of the oxide in solution in water, has a sweetish taste, and exhales a strong odour. It produces no change on vegetable blues. The oxide of osmium may be also prepared, by mixing a quantity of nitre with the black powder from crude platina, and by subjecting the mixture, in a retort, to a degree of heat under redness; a fluid of an oily consistence is sublimed in the neck of the retort, and concretes, on cooling, into a solid semi-transparent mass, which is soluble in water. This is also a solution of the oxide of osmium. If a quantity of quicksilver be agitated in any of these solutions, the peculiar odour is destroyed, the osmium is revived, and forms an amalgam with the mercury; and by subjecting the compound to heat, the mercury is driven off, and the osmium is reduced to the metallic state.

Osmium has some degree of metallic lustre, and is of a bluish colour. When heated in close vessels it is not volatile, but when heated in the open air it evaporates, while at the same time it exhales its characteristic odour. Osmium resists the action of all acids; but it readily combines with potash by fusion; the solution communicates to the skin a permanent dark stain. By the addition of alcohol or ether to the solution of the oxide in water, the colour is deepened, the oxide is reduced, and the metal is precipitated in the form of a black filmy substance. Most of the metals, when introduced into the solution of the oxide of osmium, deprive it of its oxygen, and in the state of oxide combine with the osmium.

Sect. VII. *Silver and its Combinations.*

Silver, from its beauty and brilliancy, has been always an object of research among mankind; and although it is neither in such abundance, nor so universally diffused as some other metals, yet it is found native in five different states; in the metallic state, in the state of alloy with other metals, especially with antimony, in that of sulphuret, sulphuretted oxide, muriate, and carbonate. Native silver, which is characterized by its ductility and specific gravity, is usually alloyed with a little gold or copper.

The analysis of an ore of silver is varied according to its nature and combinations. Native silver, after being broken down and well washed, is rubbed and strongly triturated with liquid mercury; and the amalgam thus formed being subjected to pressure, to separate the excess of quicksilver, is distilled, and afterwards heated in a crucible to volatilise the mercury. When the silver is combined with antimony and sulphur, the ore is strongly roasted to separate these substances; the sulphuretted oxide is treated in the same way, and the silver which remains is then melted with a proper quantity of alkaline flux. But to obtain the silver in a state of purity, it must undergo the process of cupellation, similar to what has been already noticed in describing the process for the purification of gold.

Properties.—Silver, which is of a fine white colour, is remarkable for its brilliancy; the specific gravity is 10.4, and when hammered 10.5, and sometimes nearly 11; and the hardness is intermediate between iron and gold. The elasticity is considerable, and it is very sonorous. It is very ductile and malleable; a grain of silver may be drawn into a wire 400 feet in length; and the tenacity is such, that a wire one-tenth of an inch in diameter will support 240 lbs. weight.

Silver melts at a white heat; the temperature necessary for its fusion has been estimated at 1000° Fahrenheit; but according to others, it requires 22° of Wedgewood's pyrometer. The surface of melted silver is so extremely brilliant, that it seems to throw out sparks, an appearance which is known to the workmen by the name of *corruscation.* If the heat be increased, it rises in vapour, and by slow cooling after fusion it exhibits a crystalline structure.

Silver is not changed by exposure to the air, although it is soon tarnished by sulphureous vapours, forming a thin covering of sulphuret of silver. After being long exposed to strong heat in an open vessel, it is converted into an oxide. The same combination is effected with more facility by the heat of a burning-glass, or by means of electricity or galvanism. The oxide of silver is of a greenish or olive colour; it is composed of between seven and eight parts of oxygen in the hundred; and the affinity of oxygen for this metal is so feeble, that it is decomposed by the application of heat, and even by the action of light.

Silver enters into combination with phosphorus, and forms a phosphuret; and it combines readily with sulphur, both in the dry and humid way. When sulphur and silver are fused together, the mass assumes a deep violet colour, and is more fusible than the silver, brittle, crystallized, and, with a metallic lustre, is so soft that it may be cut with a knife. A similar combination is effected when silver is exposed to sulphureous vapours; and the tarnishing of a silver spoon, which is employed in eating a boiled egg, is a thin layer of sulphuret of silver, which is usually of a dark or violet colour, produced by the sulphuretted hydrogen gas exhaled from the egg.

Silver forms salts with most of the acids, and alloys with most of the metals.

Sulphate of silver.—When sulphuric acid, which has no action on silver in the cold, is boiled with filings or small pieces, in the proportion of one part of the metal to three or four parts of the concentrated acid, an effervescence, with the evolution of sulphurous acid gas, takes place; a white powder is formed, which is entirely soluble in water, acidulated with sulphuric acid; and with excess of acid, a colourless solution, which is very acrid and caustic, is obtained. Crystals in the form of fine prisms or needles, are formed by evaporation; or, if the solution be more concentrated, it crystallizes in brilliant compressed four-sided prisms. This salt is not very soluble in water; it fuses with heat, blackens, and is decomposed. A similar decomposition is effected by light as well as by phosphorus and sulphur in the cold, and by charcoal at a red heat. It is also decomposed by all the alkalies and the alkaline earths, and the oxide which is precipitated is re-dissolved by ammonia.

Sulphite of silver.—Sulphurous acid unites readily with the oxide of silver, and the compound is in the form of small shining grains, of a pearly white colour. Sulphurous acid precipitates the solution of silver in nitric acid in the form of a white powder, which is sulphite of silver; and the same salt is produced by adding a solution of sulphite of ammonia, to a solution of nitrate of silver. By adding the sulphite in excess, the precipitate is re-dissolved, and a triple salt is formed, which, by the action of the sun's rays, is soon covered with a pellicle of silver; and the remaining liquid contains only sulphate of ammonia, the oxygen of the silver having united with the sulphurous acid and converted it into sulphuric acid.

Nitrate of silver.—Nitric acid has a powerful action on silver, and dissolves more than half its weight of the metal with the evolution of nitrous gas. The solution is nearly colourless, very heavy, and extremely caustic; it communicates first a reddish purple, and then a deep black colour, where it comes in contact with the skin. The taste, when it is largely diluted with water, is astringent and bitter. By evaporating the solution till a pellicle appear on the surface, and by slow cooling, crystals, sometimes square, sometimes triangular or six-sided, are obtained.

This salt is extremely bitter, from which it has received the appellation of the *gall of metals*; it is not deliquescent in the air; but when exposed to the sun's rays it blackens, and the silver is reduced. When heated in a crucible it melts into a brown liquid, is deprived of its water of crystallization, and when cooled assumes the form of a dark gray mass. If it be cast into cylindrical moulds when in this state of fusion, it is well known in surgery by the name of *lunar caustic*, or *lapis infernalis.* But this substance is usually prepared by evaporating the solution of nitrate of silver to dryness, without previous crystallization. If the nitrate of silver be strongly heated in a retort, it is decomposed; nitrous gas, oxygen gas, and azotic gas, are successively evolved, and the silver is reduced at the bottom of the vessel. This salt is readily decomposed by means of charcoal; if a crystal of nitrate of silver, well dried, be placed on burning coals, it produces a brilliant detonation, the silver is reduced, and adheres to the surface of the charcoal. The nitrate of silver is also reduced by means of hydrogen gas and phosphorus. If silk, moistened with an aqueous solution of nitrate of silver, be exposed to the action of hydrogen gas, it is coated with metallic silver in consequence of the reduction of the salt; and if a cylinder of phosphorus be immersed in a similar solution, it acquires a coating of metallic silver, in consequence of the phosphorus depriving the silver of its oxygen.

Nitrate of silver is decomposed by sulphuric acid, Silver. and a white powder is precipitated. Muriatic acid produces a copious white precipitate in the form of thick heavy flakes; and it is also decomposed by all alkaline and earthy matters.

Fulminating silver.—This remarkable compound is prepared by precipitating a solution of pure silver in nitric acid by means of lime-water, drying the precipitate on paper, and adding pure caustic ammonia, which produces an effect somewhat similar to the slaking of lime, at the end of ten or twelve hours. If the solution be left at rest, a shining pellicle appears on the surface, which is re-dissolved with the addition of more ammonia; but if a sufficient quantity were added at the first, no pellicle would be formed. The liquid being separated, a black precipitate is found at the bottom of the vessel. This precipitate is fulminating silver, and is to be divided into small portions on separate papers till it is dry, to avoid the danger of serious accidents; for even when it is moist, it is apt to explode with great violence, if it be struck or pressed with a hard body. The phial in which it is preserved should be only covered with paper, for, when it is dry, the slightest touch produces an explosion. In the preparation of this explosive substance, it is necessary that the ingredients employed be very pure, otherwise it is apt to fail.

As most metallic substances have a stronger affinity for oxygen than silver, it is precipitated by them from its solution in nitric acid, either partially or entirely deprived of its oxygen, and in the metallic state.

Arbor Dianæ.—In the precipitation of nitrate of silver by means of mercury, the silver is reduced to the metallic state, and in an arborescent form. If one part of silver be dissolved in diluted nitric acid, and if the solution be farther diluted with 20 parts of pure water, and two parts of mercury be added at the end of 40 days, the silver tree, it is said, is formed. But by another process, an amalgam in the cold is prepared of four parts of silver leaf, and two of mercury, and this amalgam being dissolved in nitric acid, the solution is to be diluted with water to the amount of 32 times the weight of the metals. By introducing, in a part of this liquid, a small ball of soft amalgam of silver, the arborescent appearance immediately takes place. The silver tree is also formed by putting a soft amalgam of silver into six parts of a solution of nitrate of silver, and four of a solution of nitrate of mercury. In these processes, the silver being deprived of its oxygen by the mercury, is precipitated in the metallic state, and assumes the arborescent form. Silver is also precipitated from its solution in nitric acid by means of copper.

Muriate of silver.—Muriatic acid produces no action with silver, but if muriatic acid be added to the sulphate or nitrate of silver dissolved in water, a precipitate is formed. This muriate of silver is called *corneous silver,* from its resemblance to some kinds of horn, when it is fused by heat into a mass; it is very insoluble in water; and hence nitrate of silver is a delicate test of muriatic acid, or any of the muriatic salts in mineral waters. The muriate of silver is not decomposed by any of the acids or the pure alkalies; but it is decomposed by the alkaline carbonates, and it is soluble in caustic liquid ammonia. When this solution is exposed to the air, an iridescent pellicle forms on the surface, increases in thickness, and at last assumes a black colour. The substance which is thus separated is muriate of ammonia, having a small proportion of the reduced metal combined with it. But according to the new views of the constitution of muriatic acid, this salt is a compound of chlorine and silver, and is therefore a chloride of silver.

The oxide of silver enters into combination with most of the other acids, and the saline compounds thus obtained are generally insoluble. The acetate of silver, which may be prepared by adding acetate of potash to a solution of nitrate of silver, is a very soluble salt with an acrid metallic taste.

The oxide of silver is soluble in ammonia, but when this solution is exposed to the light, it is decomposed with the evolution of azotic gas, one of the constituent parts of the ammonia, while the hydrogen, its other element, unites with the oxygen of the oxide, and the metal is reduced. The oxide of silver combines with some of the earths, and forms a vitreous mass, which communicates a yellow, olive, green, or brownish shade to glass or enamels.

Alloys.—Silver forms alloys with most of the metals. With many of them it becomes brittle, with some more fusible, and with others harder. The alloy of silver with copper, which is one of the most useful, gives hardness to the silver, and unless the proportion of copper be considerable, the colour is not diminished. This alloy is therefore extensively employed in the fabrication of various utensils as well as of silver coin. The standard silver of the British silver coin is composed of 11 parts of silver and one of copper.

Sect. VIII.—*Mercury and its Combinations.*

Mercury, called also quicksilver, from its colour, and from being always in the state of liquid at the ordinary temperature of the atmosphere, seems to have been known from the earliest ages. It exists in nature in four different states; in the state of nature, or virgin mercury; alloyed or amalgamated with other metals, and very frequently with silver; in the state of sulphuret, or cinnabar, or native vermilion; and in the state of muriate or horn silver ore.

If the ore of mercury be alloyed with other metals, it is to be dissolved in nitric acid; the gold in combination with it falls to the bottom in the state of powder; bismuth is precipitated by adding water, which does not separate the oxide of mercury, and silver is thrown down by means of muriate of soda. The muriate of mercury is also precipitated, but as it is more soluble in water than the muriate of silver, it may be easily separated. If the ore of mercury to be examined be the sulphuret or native cinnabar, it may be boiled with eight times its weight of a mixture of three parts of nitric acid, and one part of muriatic acid. By this process the metal is dissolved, and the sulphur falls down.

Mercury may be suspected to be impure, when its lustre and brilliance are diminished, or by its soiling the hands, or when it divides with difficulty into round globules, or when the globules do not run readily together. Mercury may be purified by rubbing together two parts of cinnabar and one of filings of iron, and distilling the mass in an iron retort, the beak of which is admitted into a receiver with water, the iron unites with the oxygen and the sulphur, and the mercury rising in vapour, being condensed by the water, is afterwards dried and passed through a skin.

Mercury, in this state, is of a white colour, extremely brilliant; the specific gravity is 13.56., and it has neither taste nor smell; it is always liquid till the temperature is reduced to 40° below 0 of Fahrenheit. In the solid state it has some degree of malleability; it boils at 660°, and is then converted into vapour, and this vapour, like common air, is invisible and elastic.

Mercury exposed to the air is soon tarnished on the surface, on which a black powder is formed. This process is greatly promoted by heat and agitation, and the black powder is an oxide, formerly called *Ethiops per se*, and contains about four parts of oxygen in the hundred. The oxygen is driven off by a strong heat, but when the oxide is exposed to a more moderate heat, the red oxide or red precipitate is formed, which contains about double the quantity of oxygen in the black oxide. When this oxide is exposed to heat, part of its oxygen is driven off, and it is converted into the black oxide. This change is also effected, by exposing the red oxide to the rays of the sun. Red precipitate has an acrid disagreeable taste, acts powerfully on animal matters, and corrodes the skin, and may therefore be considered as a poison.

Phosphorus combines with mercury; the compound is solid and of a black colour, and may be cut with a knife; but when it is exposed to the air, it exhales the vapours of phosphorus; mercury also combines with sulphur. One part of the metal and two of sulphur rubbed together in a mortar, form a black powder, which was formerly called *Ethiop's mineral.* When this compound is heated in an open vessel, the sulphur takes fire and is converted into sulphurous acid gas, while the mercury, being more strongly oxidated, assumes the appearance of a deep violet coloured powder, which being sublimed in a matrass, a cake of a deep red shining crystalline appearance is formed. This product, formerly denominated *artificial cinnabar*, is the red sulphuret of mercury, which, being reduced to fine powder, constitutes the vermilion of the shops. It is composed of about 15 parts of sulphur, and 85 of mercury.

Sulphate of mercury.—According to the temperature in which the combination is made, the quantity of acid employed, different sulphates of mercury are obtained. Sulphuric acid produces no effect on mercury in the cold; but three parts of sulphuric acid and two parts of mercury exposed to heat in a retort, give out sulphurous acid gas with effervescence. When the mercury is changed into a white mass, and the process stopped, when some of the liquid remains, which is acrid and corrosive, and reddens vegetable blues, the mass is found to be a super-sulphate of mercury, in which the proportion of acid seems to be different, according to the quantity employed. This salt being washed with a smaller portion of water than is required for its complete solution, and the washing being continued till the water no longer changes vegetable blues, the remaining white salt is without acidity, and less acrid and corrosive than the saline mass from which it is obtained.

This salt, which is considered a neutral sulphate, crystallizes in plates or in fine needle-shaped prisms, is not acrid to the taste, and is soluble in 500 parts of cold water, and in half the quantity of boiling water, without decomposition. The pure alkalies and lime water occasion a precipitate of a greyish black powder; and when sulphuric acid is added, it becomes more soluble, and is reduced to the state of super-sulphate.

But if the same proportions of the acid and the metal be exposed to the action of heat for a longer time, a saline compound is obtained, in which the proportion of the oxygen in the mercury is greater, from the decomposition of a larger quantity of acid. This salt crystallizes in small prisms; when neutralized, it is of a dirty white colour, but when dry is of a pure white, contains an excess of acid, and is deliquescent in the air. If hot water be poured upon this salt, it is converted into a yellow powder, which has been long known by the name of *Turpeth mineral.* This yellow substance is a super-sulphate of mercury, which is soluble in 600 parts of boiling water. But another sulphate, which contains an excess of acid, remains in the solution, and is therefore more soluble in water. Thus it appears that there are three sulphates of mercury; the first is neutral; the second is a super-sulphate, is more soluble than the former, and is precipitated of an orange colour by means of the alkalies; and the third contains an excess of base, is of a yellow colour, and forms, by means of the alkalies, a grey precipitate.

If ammonia be added to a solution of the neutral sulphate of mercury, a copious grey precipitate is thrown down; and this precipitate being exposed to the rays of the sun, is partly reduced to the metallic state, and partly to the form of a grey powder; this grey powder is a triple salt, or the sulphate of ammonia and mercury, is soluble in ammonia, and affords by evaporation shining crystals.

Nitrate of mercury.—When nitric acid is poured upon mercury, a rapid decomposition with the evolution of nitrous gas is effected. When this solution is made in the cold, a heavy, colourless, and caustic liquid, formerly employed as an escharotic, under the name of *mercurial water*, is formed. This liquid produces an indelible dark brown spot on animal and vegetable matters, and affords, by spontaneous evaporation, regular transparent crystals, composed of two four-sided pyramids; but the forms of the crystals are different, according to the nature of the solution and the greater or less rapidity of the evaporation. This is considered a neutral nitrate of mercury, but it appears that there are three nitrates; the first is prepared in the way just mentioned; the second, or the super-nitrate, is obtained by dissolving the first in water containing nitric acid, or by adding nitric acid to the other nitrates; and the third, which is a sub-nitrate, in which the base is in excess, exists in the solution precipitated by water, or by exposing the other nitrates to the action of heat, by which a portion of the acid is driven off, and in this way is produced what was formerly called *nitrous turpeth.*

The different nitrates of mercury have some common properties, but have sufficiently distinct characters, especially in their decomposition. The nitrate, placed on burning coals, detonates feebly, but with a vivid white flame; the sub-nitrate is still more feeble in its detonating property; and the super-nitrate melts rapidly, swells up, and exhales red vapours, with scarcely any detonation. If the neutralized nitrate be heated in a crucible, without combustible matter, it is decomposed, gives out nitrous gas, becomes yellow, orange, and at last deep red. This was formerly called red precipitate, and is the red oxide of mercury.

When the nitrate of mercury is exposed to the air in the state of crystals, it absorbs oxygen, and passes from a white to a yellow colour. This is the *nitrous turpeth*, or sub-nitrate of mercury. The nitrate of mercury is decomposed by all the alkalies, but the effects are different, according to the state of the combination and the nature of the oxide which forms the compound.

Fulminating mercury.—A fulminating powder, which was first prepared by Mr Howard, is obtained from a solution of mercury in nitric acid, by the following process: A hundred grains of mercury are dissolved with heat in a measured ounce and a-half of nitric acid. This solution being poured cold upon two measured ounces of alcohol previously introduced into a convenient glass vessel, a moderate heat is applied till an effervescence is excited. White fumes then begin to undulate on the surface of the liquid, and the powder is gradually precipitated. The precipitate is to be immediately collected on a filter, washed with pure water, and carefully dried in a heat not much exceeding that of a water-bath. To prevent the re-action of the nitric-acid, the immediate washing of the powder should be attended to, and while any of the acid adheres to it, it is very apt to be changed by the action of light. It should be recollected, that the mercurial solution is to be poured upon the alcohol.

The same powder may be prepared from the red nitrous oxide, as well as from the nitrous turpeth; but when quicksilver is employed the process is less expensive, to which the particular specific gravity of the acid or the alcohol seems not to be essential. Rectified spirit of wine, and the nitrous acid of commerce, answer sufficiently well for the preparation of fulminating mercury. It is observed, that the product varies in different circumstances, in its amount, colour, and strength; the whitest seems to be the strongest, and the greatest product is obtained when a vessel is used which condenses and causes most ether to return into the mother-liquor. Some attention is necessary in the application of the heat, for the action produced ought to be speedy but not violent.

When this powder is struck with a hammer on an anvil, it explodes with a stunning disagreeable noise, and it leaves an impression both on the hammer and the anvil. When it is quite dry, half a grain, or not more than a single grain should be employed. A similar effect is produced when the shock of an electric battery is sent through five or six grains of the powder. The degree of heat necessary for its explosion, is the 368th of Fahrenheit. When the powder was employed in such quantity as to discharge a bullet from a gun, with a greater force than an ordinary charge of gunpowder, it always burst the piece. From ten grains of the powder exploded in a glass globe, four cubic inches of air, composed of carbonic acid and azotic gases were obtained.

The fulminating powder is decomposed by sulphuric, nitric, and muriatic acids; and with sulphuric acid an immediate explosion is produced. The nature of the component parts of this powder varies, according to the mode in which the process is conducted; but it consists chiefly of oxalate of mercury, and nitrous etherised gas, so that oxalic acid is formed during the decomposition of the alcohol, and the nitrous gas combines with the vapour of ether, which is also one of the products of the chemical changes induced by the different agents on each other.

Muriatic acid, according to the former opinions of its constitution, combines with oxide of mercury in different proportions, and affords two very different compounds. The first is the neutral muriate, or corrosive sublimate, and the second is the sub-muriate or calomel.

Muriate of mercury.—If two parts of mercury be boiled with two and a-half of sulphuric acid in a matrass with the heat of a sand-bath to dryness, and if four parts of dried common salt be mixed with the dry mass, which is sulphate of mercury, and sublimed in a glass vessel, by gradually increasing the heat; the muriate of mercury is formed in the state of a white semi-transparent mass, composed of small prismatic crystals. The taste of this salt is extremely acrid and caustic; the specific gravity is 5.13; it is soluble in 20 parts of cold, and in less of boiling water, from which it may be obtained by evaporation in the form of cubes, rhomboidal or four-sided prisms with unequal sides, and terminated by two-sided summits. It remains unaltered in the air, and may be sublimed by heat without change; is soluble in sulphuric, nitric, and muriatic acids, and is obtained from these solutions by evaporation unchanged; the alkalies and earths throw down an orange-yellow precipitate; the carbonates of the fixed alkalies produce a permanent yellow colour; and ammonia forms a triple salt.

Muriate of mercury, or *corrosive sublimate*, its older name, is a most deadly poison when taken internally; and, when applied externally, corrodes the skin, and is sometimes employed for destroying fungous flesh. The component parts of this salt are 82 of oxide and 18 of acid. But, according to the new doctrines of the constitution of muriatic acid, it is composed of chlorine and mercury, in the proportions of 100 of mercury and 36 parts of chlorine.

Sub-muriate of mercury.—If three parts of mercury, with four parts of corrosive sublimate, be rubbed together in a mortar till the former disappear, and the mass being put into a matrass, and sublimed with a sand-heat, a white matter is deposited at the upper part of the vessel, which being separated from a red substance at the bottom, and again sublimed, reduced to powder, and repeatedly washed with boiling water, is the sub-muriate of mercury, or *calomel*, or *sweet mercury*.

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Calomel is usually in the form of a white solid mass, but it is sometimes crystallized. It has scarcely any taste, and has no poisonous quality; the specific gravity is 7.17; it is little soluble in water, becomes darker when exposed to light, is phosphorescent when rubbed in the dark, and requires a higher temperature for its sublimation than corrosive sublimate. By means of nitric, or oxymuriatic acid, calomel is converted into corrosive sublimate.

This salt was well known to the alchemists, and was distinguished by a great variety of fanciful names. Its use in medicine is familiar, and it contains about eleven parts of acid to 89 of oxide, according to the former doctrine; but considering it a compound of chlorine and mercury, it consists of 18 parts of the former, or exactly half the proportion of chlorine that exists in corrosive sublimate.

A triple salt is formed by adding ammonia to a solution of corrosive sublimate; it is in the state of a white precipitate, insoluble in water, and was denominated by the alchemists *sal alembroth* and *salt of wisdom*.

The oxide of mercury forms salts with almost all the other acids. The acetate of mercury with excess of acid, may be formed by dissolving the precipitate obtained by alkalies from nitrate of mercury in acetic acid, or by mixing together solutions of acetate of potash and nitrate of mercury. The acetate is in the form of large flat crystals, which have an acrid taste, and are scarcely soluble in water. This salt is the chief ingredient in *Keyser's Pills*.

Alloys.—The alloys of mercury, called *amalgam*, are numerous. It combines with most of the metals, and gives some of them a soft consistence. It unites with gold and silver, and is employed in separating them from their ores, as well as in the processes of gilding with those metals. With zinc soft amalgam is formed, which is applied to the cylinder of electric machines to increase their power; and with tin it affords an amalgam for covering the back of mirrors.

Sect. IX. *Copper and its Combinations.*

Copper seems to have been among the first metals which was employed by the early nations of the world. It is easily extracted from the ores, and it is not difficult to work, and therefore it appears to have been applied to numerous uses by the Egyptians, Greeks, and Romans.

Copper is met with in nature in considerable abundance, and in the different states in which metallic ores are found; native, in a crystallized or arborescent form; in the state of sulphuret, one of the most common ores; in that of oxide, more rare; and in that of saline compound with sulphuric, but more frequently with carbonic acid. The extraction of copper from its ores is varied according to the nature of the combination. The sulphuret being reduced to powder is boiled with five parts of concentrated sulphuric acid, the solution is evaporated to dryness, and the residue is well washed with warm water to separate all the soluble part. The salt being dissolved and diluted with water, a plate of copper is immersed to precipitate the silver, after which a plate of iron throws down the copper, and as long as any precipitate is formed the solution is kept at a boiling heat. The precipitate of copper is to be dried with a moderate heat; and if it be supposed that it is contaminated with iron, it may be dissolved in nitric acid, and again precipitated with a plate of iron, and by fusing the precipitate it is obtained in the solid form.

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Copper is of a pure red colour, very brilliant; the specific gravity is 8.58, has a disagreeable odour, and a peculiar astringent taste, and when taken internally acts as a poison. It is very malleable, and has considerable ductility, and great tenacity. A wire, 1-10th of an inch in diameter, can support a weight equal to 300 pounds.

Copper is fused at 27° of Wedgewood, or at 1450° of Fahrenheit, by estimation. When slowly cooled it crystallizes in quadrangular pyramids, or in octohedrons.

Copper, exposed to moist air, is soon tarnished, becomes of a dull brown colour, and is at last covered with a green crust of verdigrise. This process of oxidation is promoted by moisture, and the carbonic acid of the atmosphere combines with part of the oxide, so that verdigrise is a mixture of oxide and carbonate of copper.

The oxidation of copper proceeds with greater rapidity when it is subjected to strong heat; if a plate of copper be made red hot, in contact with the air, it becomes of a deep brown colour, and the external layer, which is of the same colour, may be detached from the metal. From its colour this is called the brown oxide of copper, and it may be obtained by immersing a plate of red hot copper in cold water; scales are formed on the surface, and fall off by the sudden contraction of the heated copper, and if the same process be repeated the whole of the copper may be converted into an oxide. In this state the copper is in the highest degree of oxidation. The same oxide, which is of a black colour, may be prepared by dissolving copper in nitric, or sulphuric acid, and precipitating the oxide by means of an alkali. The constituent parts of this oxide are 25 parts of oxygen and 75 parts of copper.

But if the black oxide of copper be mixed with less than an equal proportion of metallic copper, in fine powder, rubbed in a mortar, and put into a close vessel with muriatic acid, the copper is dissolved, and the oxide is precipitated of an orange colour by potash. This oxide contains more than 11 parts of oxygen in the 100. When exposed to the air, it soon changes colour, by the absorption of oxygen.

Copper readily combines with phosphorus, and forms with it a phosphuret, which may be prepared by fusing equal parts of copper and phosphoric glass with charcoal powder: or it may be formed by projecting phosphorus on red hot copper in a crucible. This phosphuret has some metallic lustre, is of a whitish grey colour, of a close texture, and is more fusible than copper. Exposed to the air it is deprived of its brilliancy, grows black, and is covered with a kind of efflorescence, which is phosphate of copper, the phosphorus having combined with the oxygen of the atmosphere.

Copper unites also readily with sulphur. The sulphuret of copper may be prepared by mixing to-

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gether sulphur in powder and filings of copper, forming them into a paste with water, and exposing them to the air. The mass swells up, becomes hot, and is converted into a brown matter. The same sulphuret may be also formed by heating together in a crucible equal parts of sulphur and copper filings. By this process a deep-coloured brittle mass is obtained, which is more fusible than copper. This substance, formerly called *æs veneris* is employed in dyeing, and is prepared by stratifying plates of sulphur and copper in a crucible, melting it into one mass, and afterwards reducing it to powder. The compound of sulphur and copper, or the sulphuret, is one of the most common ores of that metal.

Sulphate of copper.—When sulphuric acid and copper are boiled together, the acid is decomposed, sulphurous acid gas is given out, and a sulphate of copper, which affords, by evaporation and slow cooling, crystals of a fine blue colour, is obtained. This salt is in the state of super-sulphate, for it reddens vegetable blues; it has a strong styptic and metallic taste, and is very acrid and caustic; the specific gravity is 2.19; it is soluble in four parts of cold, and in two parts of boiling water, effloresces slowly in the air, and is converted by heat into a bluish white powder. With an increase of temperature the acid is entirely driven off, and the oxide remains behind.

This salt is known in commerce under the names of blue copperas, blue vitriol, or vitriol of copper. It is met with in great abundance in nature, and is obtained either by evaporating the water which holds it in solution, or by exposing the sulphuret of copper to the action of air and moisture, by which it is converted into the sulphate.

Sulphate of copper is decomposed by the alkalies and earths, and precipitated in the form of a bluish grey oxide, which assumes a green colour when it is exposed to the atmosphere by the absorption of carbonic acid. The precipitate formed by ammonia is again dissolved by an excess of the alkali, and the liquid becomes of a fine blue colour.

Copper is reduced to the metallic state from its solution in the acids by several metals, as iron, zinc, and tin. If a plate of iron be immersed in a solution of copper in an acid, the iron is soon covered with metallic copper. By this process copper is obtained from its natural solutions in water.

Sulphite of copper.—The oxide of copper readily combines with sulphurous acid. The sulphite of copper may be also prepared by adding a solution of sulphite of soda to sulphate of copper. An orange-yellow precipitate is formed, and small crystals of a greenish-white colour are deposited. Both these precipitates are sulphates of copper. In the yellow precipitate the proportion of oxide of copper is greatest; but in the green precipitate the sulphite is saturated, and it is soluble in water, from which it may be obtained crystallized. These salts, heated under the blowpipe, melt, blacken, and are at last reduced to the metallic state. When nitric acid is added, they are converted into sulphate of copper; and by sulphuric acid the sulphurous acid is expelled, and a brownish coloured matter remains behind in the state of powder. This powder is an oxide, mixed with some metallic copper.

Nitrate of copper.—When copper is introduced into nitric acid, a rapid decomposition takes place; nitrous gas is given out, the metal is oxidated, and the oxide is dissolved in the acid. The solution, at first of pale blue, becomes of a deeper colour, and, by slow evaporation, affords crystals in the form of long parallelopipeds. The taste of this salt is styptic; it is extremely caustic, and corrodes the skin; deliquesces in the air, and is very soluble in water; melts at a very moderate heat, and, by increasing the temperature, the water of crystallization is driven off.

The nitrate of copper is precipitated from its solutions by the alkalies and earths, and a bluish white oxide is thrown down. When the precipitate is formed with potash, a bulky mass of a fine blue colour is obtained. If lime be added to the solution, the shade of blue becomes deeper. In this way, the blue pigment called *verditer* is prepared. This substance is used for painting paper.

By distilling the nitrate of copper in a retort, the salt becomes thick, and forms a green crust, which is a sub-nitrate. It has an excess of base, and is insoluble in water.

Muriate of copper.—Copper is dissolved in concentrated muriatic acid with the aid of heat; an effervescence takes place, and hydrogen gas is given out. The solution is of a fine green colour, by which it is easily distinguished from the sulphate and nitrate of copper. This salt may be prepared by the direct combination of diluted muriatic acid with the green oxide of copper, and, by evaporation and slow cooling, the solution affords crystals in the form of long small needles of a fine grass-green colour. The taste of this salt is acrid and caustic; it deliquesces in the air, and assumes a thick oily appearance; melts at a moderate heat, and becomes of a uniform mass by cooling, and is not decomposed by sulphuric or nitric acids; a bluish white oxide is thrown down by the alkalies, and the copper is precipitated by means of zinc and iron. This salt is considered to be formed with the oxide in the highest degree of oxidation. Another salt is also obtained with muriatic acid and copper in its lowest degree of oxidation; and a third, in which an excess of base exists. But, according to the new doctrine of the constitution of muriatic acid, these muriates of copper are compounds of chlorine and copper in different proportions.

The oxide of copper forms also saline compounds with boracic and phosphoric acids, both of which are nearly insoluble in water. Carbonate of copper may be prepared by adding an alkaline carbonate to any of the solutions of copper in the other acids; and to obtain it of a brilliant and uniform colour it should be precipitated with boiling water, washed carefully, and the vessel containing it should be placed in the sun. The native carbonate of copper, called *malachite*, is often one of the most splendid mineral productions, and it is composed of the same proportions of acid and oxide as the artificial carbonate.

Arseniate of copper.—By digesting arsenic acid and copper, or by adding an alkaline arseniate to nitrate of copper, a green solution is obtained, and the arseniate of copper is thrown down in the form of a bluish white powder. If the arseniate of potash be add-

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ed to a solution of sulphate of copper, a rich green precipitate is formed, which is not changed in the air, and being proposed by Scheele as a paint, has been denominated *Scheele's green.* This arseniate of copper may be prepared by dissolving potash in water, and adding the white oxide of arsenic till the potash is saturated; the filtered liquid is to be added gradually to a solution of sulphate of copper while it is hot, and stirring the mixture at the same time. Being left at rest, a beautiful green powder falls down, and the precipitate is to be repeatedly washed with water and dried.

Acetate of copper.—Acetic acid readily dissolves copper, with the assistance of heat, and the oxide thus formed is the verdigrise of commerce When plates of copper are exposed to the action of vinegar, a bluish green powder is formed on the surface. This powder being dissolved in acetic acid, affords a solution of a greenish blue colour, which, by evaporation, yields crystals of a deep blue colour, and in the form of quadrangular truncated pyramids. This salt has a strong disagreeable taste, and, like the other preparations of copper, is poisonous, effloresces in the air, and is very soluble in water; is decomposed by the alkalies, and gives out acetic acid by distillation.

Oxalate of copper.—Oxalic acid acts upon copper, and forms with it needle-shaped crystals, of a green colour: it unites with the oxide of copper, and the compound is in the state of a bluish-green powder, which has little solubility in water, and it precipitates the sulphate, nitrate, and muriate of copper in the form of a bluish-grey powder.

Prussiate of copper.—The prussiate of potash forms, with the sulphate, nitrate, and muriate of copper, precipitates of a very beautiful colour; but the finest and deepest colour is obtained from the muriate, which precipitate has been proposed to be employed as a paint, and, it is said, has been found to answer both with oil and water.

The fixed alkalies dissolved in water, and digested on copper filings, promote the oxidation of the metal with the access of the air, and the liquid becomes of a blue colour. With liquid ammonia the colour is brighter, although a very small proportion of the oxide is dissolved. By slow evaporation the greater part of the ammonia is separated, and when it is evaporated to dryness, an oxide of copper only remains behind.

Alloys.—Copper combines with almost all the metals by fusion With arsenic, a white brittle alloy, called *white tomback*, is formed. One of the most useful alloys is formed with copper and zinc. In the proportion of one-fourth part of zinc to three-fourths of copper, an alloy of a fine yellow colour, less liable to tarnish, and more fusible than copper, is obtained. This alloy is brass. When three parts of zinc are united to four parts of copper, the alloy obtained is well known by the names of princes metal, or pinchbeck. It has less malleability than brass; but its fine golden colour is pretty permanent in the air.

The alloy with tin is called *bronze*, which is employed in casting statues, and cannons, for bell metal, and metallic mirrors. The ductility of the copper is diminished by the tin; but its hardness and sonorous quality are increased.

Sect. X. *Iron and its Combinations.*

Iron.

Iron is one of the most useful of the metals, and is at the same time most abundant and most universally diffused. It is met with in the metalic state, or in that of alloy with other metals, frequently combined with sulphur, in the state of carburet, or united with carbone, in the state of oxide, which is a common ore of iron, and in combination with different acids.

The method of extracting iron from its ores must be varied according to the nature of the ore, and the substances with which it is combined. But, in general, the ores of iron may be reduced by means of charcoal, which separates the oxygen, and of lime which unites with the earthy matters, and forms with them a vitreous mass.

Iron is of a greyish or bluish white colour, and is remarkable for its metallic brilliancy. The specific gravity is from 7.6. to 8.16.; when rubbed, it gives out a peculiar odour, and the taste is astringent. The magnetic virtue of iron is one of its most remarkable properties; its malleability is considerable; and it possesses great ductility and tenacity.

Iron is very infusible, and requires, it is said, 150° of Wedgewood for its fusion. Before it melts, it becomes red, and it exhibits different shades of red at different degrees of temperature. These shades are distinguished by different names as a dull red, cherry red, bright red, and white heat, or incandescence.

Iron is soon tarnished when it is exposed to the air, and is covered with a brown powder, which is well known by the name of *rust.* This process, which proceeds more rapidly in a moist atmosphere, is the conversion of the metal into an oxide, and this oxide is partly combined with the carbonic acid of the atmosphere, so that rust consists of an oxide and carbonate of iron, which was formerly called saffron of Mars.

Oxygen combines with iron in two proportions. The first, in which the oxygen is in largest proportion, is called, from its colour, brown or red oxide, and may be prepared by exposing iron filings in an open vessel to a red heat, and stirring them occasionally till they are converted into a red powder. This oxide is composed of 42 parts of oxygen, and 58 of iron. If the red oxide be mixed with its own weight of iron filings, and exposed to heat, the whole mass is converted into a black powder, which is the black oxide of iron, in which the proportions are 27 of oxygen and 73 of iron. This oxide may be formed by passing the vapour of water through a red hot tube in which iron wire or small fragments of iron are placed.

Iron readily combines with carbone, and forms with it a carburet. Plumbago, or black lead, is a natural compound of this nature, in which the iron forms about one tenth of the weight of the mineral. Steel is also a compound of iron and carbone.

Crude, or cast iron.—When iron is first extracted from its ores, by the proces of smelting, which is the separation of the oxygen and earthy matters with which it is combined, it is in the state of crude or cast iron; but in this state it is not free from oxygen, and it is combined with a considerable proportion of carbone.

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It is very brittle, and is scarcely at all malleable.

Wrought iron.—To reduce crude iron to a malleable state, it is introduced into a furnace, and melted by the flame of combustible matters directed to its surface; and while in fusion it is constantly stirred, to bring every part of the mass in contact with the air. It swells up, gives out a blue flame, and after being kept in this state for about an hour, it acquires some consistency, and at last becomes solid. It is removed from the furnace while it is hot, strongly hammered by the action of machinery, and is then brought to the state of *wrought* or *soft iron.*

Steel.—Steel is a compound of wrought iron and carbone. Different processes are followed in the preparation of steel. Natural steel is prepared by exposing cast iron to strong heat in a furnace while the surface is covered with scoriæ. After this process the iron remains in combination with a small proportion of oxygen; but this kind of steel is of an inferior quality. In preparing what is called *steel of cementation,* bars of iron and charcoal in powder, are arranged in alternate layers, in large crucibles or troughs, and are carefully excluded from the air, by closing them up with clay. After being exposed to heat in a furnace for eight or ten days, the iron is converted into steel, which is called *blistered steel.* When it is drawn out into smaller bars by the hammer, it is called tilted steel. German or sheer steel is prepared by breaking it into pieces, repeated welding in a furnace, and afterwards drawing it out into bars. Cast steel is prepared by fusing together, in a close crucible, natural steel, charcoal powder, and pounded glass in the proportion of 30 parts of iron to one part of each of the other ingredients. This is the best kind of steel, and is therefore generally used in the manufacture of the finer kinds of cutting instruments.

The properties of steel are very different from those of iron; it is very hard and brittle, resists the action of the fire, and retains the magnetic virtue for a greater length of time; when hammered, its specific gravity is greater than that of iron, and it is only malleable when it is red hot.

Iron combines with phosphorus, by fusing equal parts of phosphoric glass and iron, and one half part of charcoal powder. The phosphuret thus obtained is of a white colour, and a crystalline texture. Cold short iron, which is brittle when it is cold but malleable when it is heated, contains a certain proportion of phosphate of iron, on which this quality depends.

A sulphuret of iron is prepared by fusing in a crucible equal parts of iron filings and sulphur; the product is a brittle hard mass of a grey colour, which being reduced to powder, and moistened with water, is converted into sulphate of iron.

The sulphuret is a very abundant natural production, and it is usually crystallized in cubes.

Sulphate of iron.—When diluted sulphuric acid is poured upon iron filings, a strong effervescence with the evolution of hydrogen gas is produced. In this process the water is decomposed, its hydrogen escapes in the form of gas, and its oxygen forms with the iron an oxide, which unites with the acid, and becomes a sulphate of iron. This solution, which is of a greenish colour, affords by evaporation, transparent crystals in the form of rhomboidal prisms, which have an acrid astringent taste. This salt, which is very soluble in water, almost always reddens vegetable blues. Sulphate of iron is a natural production in many parts of the world, and it is obtained from the decomposition of pyrites or sulphuret of iron. In the manufacture of this salt, it is found necessary to promote this decomposition by artificial means; by watering the heaps, or by roasting them to render them more brittle, or to drive off any excess of sulphur. After the oxidation of the iron, and the conversion of the sulphur into sulphuric acid, the saline ingredients are washed off, and the water impregnated with the salt being evaporated, affords crystals which are known in commerce by the names of martial vitriol, green vitriol, or green copperas.

When the green sulphate of iron is exposed to strong heat, it melts, and is deprived of its water of crystallization, while sulphurous acid gas is given out. The salt falls down in the state of a red powder, which was formerly called *colcothar*, or *colcothar of vitriol.* In this state the salt is almost entirely decomposed, the iron is strongly oxidated, to which the red colour is owing, and it is mixed with a portion of sulphate of iron in which the red oxide has been formed by an additional portion of oxygen to the green oxide.

When green sulphate of iron is exposed to the air, it becomes opaque, of a yellowish colour, and a powder forms on the surface. A similar change is effected on the solution of the salt in water, if it be exposed to the air and light. In this change oxygen is absorbed, and the green oxide is converted into the red oxide.

The red sulphate of iron may be prepared by direct combination of the red oxide with concentrated sulphuric acid aided by heat. This salt remains in the solution from which the green sulphate has been crystallized, and this solution has been denominated the mother-water of vitriol. The red sulphate of iron does not crystallize; it deposits the oxide when it is heated, or in contact with the air, is deliquescent, and at last becomes liquid, and is very soluble in water, and also in alcohol. If iron filings be added to a solution of red sulphate of iron, part of the oxide is separated, another part gives up a portion of its oxygen, and is converted into the green sulphate. A similar change is effected by zinc, tin, and other metals.

The infusion of nut galls gives a black precipitate with red sulphate of iron, but produces no change on the green sulphate. With the red sulphate of iron, prussiate of potash affords a fine deep blue precipitate; but it produces no change of colour on the green sulphate. The green sulphate of iron absorbs nitrous gas, and becomes of a yellow colour; but the red sulphate has no such effect.

Sulphite of iron.—It appears that two compounds of iron and sulphurous acid may be formed, one of which is a simple sulphite, and the other, having an additional portion of sulphur combined with it, is a sulphuretted sulphite of iron. Neither of these sulphites gives a black precipitate with the infusion of nut galls, or a blue precipitate with the prussiate of potash, from which it is concluded that the iron in the compound is in the state of green oxide.

Nitrate of iron.—Nitric acid, a little diluted with water, produces a violent action on iron, with the copious evolution of nitrous gas. The solution is of a yellowish green colour, and becomes pale when exposed to the air in consequence of the nitrous gas with which it is combined uniting with oxygen, and being converted into nitric acid. In this compound the iron is in the state of green oxide, and the oxide may be precipitated from the solution by means of the alkalies.

Red nitrate of iron.—This salt is formed by the direct combination of nitric acid with red oxide, or by exposing the green nitrate to the air, or by dissolving iron in concentrated nitric acid. The solution of this salt is of a brown colour; it does not crystallize, and when it is evaporated, it assumes the form of jelly, or deposits a red powder. The acid is driven off by heat, and the red oxide remains behind. The solution of this salt gives a black colour with the infusion of galls, and a blue precipitate with prussiate of potash.

Muriate of iron.—Liquid muriatic acid has a powerful action on iron, and in proportion to the acid being less concentrated, the action is more violent. Hydrogen gas is given out, and the solution is of a pale yellowish colour, and a strong styptic taste. When it is reduced by evaporation to the consistence of syrup, a viscid mass is formed when it cools, in which appear small deliquescent crystals. When this solution is exposed to the air, or strongly heated, it becomes of a brown colour, and oxide of iron is deposited.

Red muriate of iron.—Muriatic acid dissolves the red oxide of iron, and affords a solution of a deep brown colour. When this solution is evaporated to dryness, a yellow coloured deliquescent mass remains behind. When the oxide of iron in this compound is precipitated by the alkalies, it undergoes no farther change by the action of the air. With the prussiate of potash it gives a blue precipitate, and with the infusion of nut galls a black precipitate.

Phosphate of iron.—Phosphoric acid acts slowly on iron, but it combines with both the oxides, forming either a green or a red phosphate. The red phosphate, which is nearly insoluble in acids and water, is soluble in the serum of the blood, and communicates a red colour to that animal fluid.

Arseniate of iron.—Arsenic acid forms compounds with both the oxides of iron. The green arseniate is prepared by adding a solution of arseniate of ammonia to a solution of sulphate of iron. It is in the form of an insoluble powder. The red arseniate may be prepared either by adding arseniate of ammonia to a solution of red sulphate of iron, or by boiling the green arseniate of iron in nitric acid.

Tungstate of iron is found native in the mineral called wolfram. Chromate of iron is also a natural production; and from the columbate of iron the new metal, *columbium*, was extracted.

Acetate of iron.—Acetic acid dissolves iron with effervescence, and with the evolution of hydrogen gas; the liquid becomes reddish brown, and by evaporation becomes a gelatinous mass, in which are deposited crystals of a brownish colour. This salt has a sweetish styptic taste, deliquesces in the air, and is decomposed by heat. When this salt is heated till it cease to give out the odour of vinegar, a yellowish oxide, which is easily reduced, and is attracted by the magnet, remains. The solution of this salt gives a black precipitate with the infusion of nut galls, and a blue with the prussiate of potash.

The solution of this salt, which is extensively employed in dyeing and calico-printing, is manufactured in the large way from old iron and vinegar, which is prepared from grain or molasses. They are exposed to the air in large vessels, and while the fermentation of the liquor proceeds it is converted into acetic acid. The iron is at the same time oxidated and dissolved by the acid.

Green acetate.—If sulphuret of iron be dissolved in acetic acid, the solution affords, by evaporation, green coloured prismatic crystals, which have a styptic and sweetish taste. The solution of this salt is not changed by the infusion of galls, and gives a white precipitate with the prussiate of potash. When it is exposed to the air it absorbs oxygen, and is converted into the red acetate of iron.

Gallate of iron.—When an infusion of nut galls, which is a mixture of tannin and gallic acid, is added to a solution of the salts of iron, of which the red oxide forms the base, a black precipitate is produced. Writing ink is a compound of the solution of gallate of iron and tannin, or the tanning principle. To improve the colour, and to retain the precipitate in the mixture, other ingredients, as logwood and mucilage, or gum-arabic, are added. When the green sulphate of iron is employed in the preparation of ink, the ink is of a very pale colour at first, but becomes black as the iron is converted into the red oxide.

Prussiate of iron.—When the prussiate of potash is added to the salts of iron composed of the green oxide, a white precipitate is formed, but with red oxide the precipitate is of a fine deep blue. This compound is Prussian blue. When the white precipitate obtained from the green oxides is exposed to the air, it absorbs oxygen and is converted into the blue prussiate; and if this latter be kept in a close vessel, with plates of iron or tin immersed, it is deprived of its colour, in consequence of the oxide of iron passing to the state of green oxide.

Alloys.—Iron forms alloys with most of the metals. In most cases the compound is brittle; the alloy with arsenic, which is called mispickel, is of a white colour, and is more fusible than the iron. The alloy with tin is formed with difficulty; but tin adheres strongly to the surface of iron; and this thin covering as it prevents the oxidation, or rusting of the iron, renders it fit for many valuable purposes.

Tinning iron.—Tin plate, or white iron, is prepared by the following process. The plates of iron after being reduced to the proper thickness, are cleaned by rubbing them with sand to remove the rust, and then immersing them for 24 hours in water acidulated with sulphuric acid. The plates are then to be well rubbed with cloths, that the surface may be perfectly clean. The tin is fused in a pot, and to prevent its oxidation, the surface is covered with some resinous or oily matter, and the plates of iron, while they are

Lead.

dipt in the melted metal, are either moved about in it, or the dipping is repeated several different times. After they are taken out, they are rubbed with sawdust or bran, that the surface may be cleared of all impurities.

Sect. XI. *Lead and its Combinations.*

Lead seems to have been known in the earliest ages, and it exists in great abundance, and under a great variety of forms and combinations, in many parts of the world. It is most commonly met with in the state of sulphuret; the carbonate, phosphate, and arseniate of lead are not rare; but the chromate, molybdate, and sulphate of lead are more uncommon.

The nature of the acid which is in combination with the ores of lead, will point out the nature of the process which is to be pursued in their analysis. The sulphuret, which is the most common ore, is reduced by roasting, and then fusing it with black flux; and to obtain the lead in a state of purity, it may be dissolved in nitric acid, precipitated with sulphate of soda, and after being well washed, the precipitate is reduced by fusing it with three times its weight of black flux in a crucible.

Lead is of a greyish white, or bluish white colour; the brilliancy is considerable, but it soon tarnishes in the air; the specific gravity is 11.35; it gives out a peculiar odour when rubbed; at first has scarcely any perceptible taste, but leaves a disagreeable impression on the tongue. When taken internally, even in small quantities, it produces very violent effects on the digestive organs. Lead communicates a bluish stain to the finger or paper; it is very soft; possesses considerable malleability; but in tenacity and ductility it is inferior to the other metals.

Lead melts at the temperature of 540°, or, according to others, at 594°. When kept at a red heat it sublimes and evaporates; it is soon tarnished in the air, and becomes first of a deep grey, and afterwards of a greyish white colour.

When lead is melted in the open air, and kept in a state of fusion, an iridescent pellicle forms on the surface, which gradually changes to a uniform grey colour. When this pellicle is removed another forms, and in this way the whole lead may be converted into an oxide, which is the first state of oxidation, or the grey oxide.

If the grey oxide be more strongly heated in contact with air, it combines with a greater proportion of oxygen, and is converted into the yellow oxide known in the arts by the name of *massicot*, and containing about nine parts of oxygen in the hundred.

If the yellow oxide of lead in the state of fine powder, be subjected to strong heat in a furnace for about 50 or 60 hours, it is converted into a red powder, which is well known in the arts by the name of *minium*, or red lead.

If the oxide of lead be exposed to a more violent heat, it is converted into a kind of glass, or semi-vitrified matter, called *litharge*. It is composed of small brilliant reddish scales, which, from their colour, are called *litharge of gold*. When it is more vitrified by a greater heat, it changes its appearance, and is called litharge of silver.

Lead combines with phosphorus, and forms with it a phosphuret, which may be prepared by projecting lead on melted phosphorus It is of a silvery white colour, a lamellated structure, so soft that it may be cut with a knife, and is less fusible than the component parts.

By melting sulphur and lead together in a crucible, a sulphuret is formed, which is of a blackish colour, has some brilliancy, is of a fibrous texture, and is less fusible than lead. It resembles galena, or the native sulphuret of lead.

Sulphate of lead.—When concentrated sulphuric acid is boiled with lead, sulphurous acid gas is given out with effervescence, and the lead is converted into a thick white mass. The same salt may be obtained, by adding sulphuric acid, or an alkaline sulphate, to acetate of lead in solution in water; a white powder is also precipitated. When the white mass produced by the first process is washed with water, it separates into two portions, one of which seems to be a neutral and insoluble sulphate of lead, and the other having an excess of acid, may be obtained from its solution in water, crystallized in the form of four-sided prisms. This salt has scarcely any taste; it is found native and crystallized in regular octohedrons, or in transparent tables.

If an alkali be added to sulphate of lead, a portion of the acid is removed, and the salt is converted to the state of sub-sulphate.

Sulphite of lead.—Sulphurous acid has no action on lead, but if the red oxide be added to the liquid acid, it becomes white, the acid is deprived of its odour, and a white mass, composed of sulphate and sulphite of lead, is formed. But the sulphite of lead can only be obtained separately by treating the white oxide, which is extracted from the nitrate of lead, by means of sulphurous acid. The sulphite of lead is a tasteless and insoluble salt. Under the blow-pipe, on charcoal, it melts with a phosphoric light, and becomes on cooling of a pale yellow colour, and if the heat be continued it is entirely reduced. It is decomposed with effervescence by sulphuric and muriatic acids, and the sulphurous acid is expelled. With nitric acid it is converted into sulphate, and nitrous gas is given out.

Nitrate of lead.—When nitric acid is a little diluted with water, it acts upon lead, oxidates it, and dissolves it with effervescence; but if the acid be concentrated, a dry white powder, which is a sub-nitrate, or with excess of base, is produced. This powder being dissolved in nitric acid, becomes a nitrate of lead. The nitrate of lead is soluble in water, and may be obtained crystallized by evaporating the solution. The crystals are either in the form of flat triangles or six-sided pyramids.

Nitric acid combines only with the yellow oxide of lead, and forms with it the nitrate and sub-nitrate of lead. If nitric acid be poured on the red oxide of lead, the oxide becomes white, part is dissolved, and part falls to the bottom in the form of a black powder, which is the brown oxide of lead.

The nitrate of lead is decomposed by the alkalies, and is precipitated in the form of white oxide; the sulphurets, and hydro-sulphurets throw down a black precipitate; and sulphuric acid, and the sulphates, form a thick white precipitate of sulphate of lead.

Lead.

Nitrite.—If nitrate of lead in solution be boiled with metallic lead, the salt is decomposed, and the lead is dissolved. A nitrite of lead is thus formed, the constituents of which are in different proportions, according to the quantity of lead dissolved; and it is therefore in the state of nitrite or sub-nitrite, as the acid or base predominates.

Muriate of lead.—Muriatic acid acts very feebly on lead, or its oxide, without the assistance of heat, when part of the oxide combines with the acid, and affords crystals in the form of shining silky needles. The same salt may be prepared by adding an alkaline muriate, as common salt, to a solution of nitrate of lead. A white thick precipitate is formed, which has a sweetish taste, is soluble in about 30 times its weight of water, and when heated melts readily, and gives out a white vapour, which condenses into a crystalline powder. When this salt is fused it becomes a semi-vitreous shining greyish mass, which, from its appearance, has been called *plumbum corneum*, or horn lead. But according to the new views of the constitution of muriatic acid, muriate of lead is to be considered a compound of chlorine and lead, or a chloride of lead.

Phosphate of lead.—If an alkaline phosphate be added to the nitrate of lead, an insoluble phosphate is formed, and with an excess of acid the salt becomes fusible by heat, and assumes, when it cools, the form of regular polyhedrons. This salt is decomposed by sulphuric, nitric, and muriatic acids, and by the alkaline carbonates. It is frequently found native, crystallized in green or yellow six-sided prisms.

Carbonate of lead.—Carbonic acid combines with the oxide of lead, and converts it into a carbonate, which may be also prepared by adding an alkaline carbonate to any of the soluble salts of lead. The carbonate of lead has neither taste nor smell, is insoluble in water, is found native of a whitish colour, and is crystallized in tables, in six-sided prisms, or in regular octohedrons. The specific gravity is 7.23.

Ceruse, or the white lead of commerce, is a compound of carbonate and oxide of lead; and is is prepared by exposing plates of lead to the vapour of vinegar. The acid is decomposed; part of the lead remains in the state of oxide, and the greatest proportion is converted into a carbonate.

Arseniate of lead.—If lead be digested in a solution of arsenic acid, its surface blackens, and is covered with a white powder; or if arsenic acid be added to a solution of lead in nitric acid, the arseniate of lead is thrown down. This salt melts with heat, and fuses into a white glass; it is insoluble in water.

The molybdate and chromate of lead may be prepared artificially, but they are both found native, are insoluble in water, and are decomposed by muriatic acid.

Acetate of lead.—The compound of acetic acid and lead was formerly known by the different names of *salt of Saturn*, *extract of Saturn*, and *sugar of lead.* This salt is prepared by dissolving carbonate of lead, or ceruse, in acetic acid, or by exposing thin plates of lead to the action of the acid in earthen vessels exposed to the air. When the acid is sufficiently saturated, the solution is concentrated by evaporation, and the acetate of lead is deposited in small crystals, which are in the form of flat four-sided prisms terminated by two-sided summits. This salt has an astringent sweetish taste; the specific gravity is 2.34, and without an excess of acid it is not very soluble in water; it is not changed by exposure to the air; when dissolved in water, a white powder is deposited, which is a carbonate of lead formed with the carbonic acid of the water; and the same salt is thrown down by blowing a current of air from the lungs into the solution. Acetate of lead is decomposed by heat, and by sulphuric, muriatic, fluoric, and phosphoric acids.

Sub-acetate of lead.—If two parts of sugar of lead, and three parts of dry litharge, from which the carbonic acid has been separated, be boiled together, a sub-acetate of lead is formed, in which the base predominates. *Goulard's extract,* which is prepared by boiling distilled vinegar and litharge till it is saturated, is the same salt, which is less sweet to the taste, less soluble in water, and crystallizes in plates.

The alkalies promote the oxidation of lead, in consequence of the affinity which exists between them; and the oxide of lead and these bodies, as well as the alkaline earths, readily combine with the oxide. Lime-water digested for some time with the oxide of lead in the state of litharge, dissolves it; and the solution being evaporated affords small iridescent crystals. The earths, and especially alumina and silica, combine readily with the red oxide of lead when assisted by heat; and if the proportion of oxide of lead be considerable, the compound formed is a heavy vitreous mass called *glass of lead.* This oxide is employed in the fabrication of glass. Muriate of soda, or common salt, is decomposed by means of lead, and a compound of a brilliant yellow colour, and considered as muriate of lead, is obtained. This compound has been much employed in painting, under the name of *English yellow.*

Alloys.—Lead forms alloys with many of the metals; and with mercury it forms an amalgam of different degrees of consistence, according to the proportion of the two metals. The alloy of lead and bismuth united with mercury scarcely diminishes its liquidity. Lead unites with tin in all proportions; and when three or four parts of the latter are combined with one of the former, the alloy increases the hardness of the tin. Common solder is a compound of two parts of lead and one of tin. Tinfoil is also an alloy of tin and lead. Eight parts of bismuth, five of lead, and three of tin, form an alloy which is so fusible that it remains liquid at the temperature of boiling water, and hence it it called *fusible alloy.*

Lead is employed for numerous purposes in the arts, and in domestic economy; but it should never be forgotten that its effects are extremely deleterious when taken internally, and that too much caution cannot be observed in the use of leaden vessels in which substances are prepared or preserved, and particularly those which contain acids that are apt to dissolve the lead.

Sect. XII. *Tin and its Combinations.*

Tin.

Tin seems to have been one of the earliest metals known. It was employed in the arts by the Egyp-

Tin. tians, and as an alloy with other metals among the Greeks. Tin exists in the metallic state in the form of brilliant plates, or regularly crystallized in the state of oxide, which is the most common ore of that metal, and which is also generally crystallized, and in the state of sulphuretted oxide.

In extracting tin from its ores, they are first roasted, and then treated with a flux to reduce the metal. The proportion of black flux employed is about three times the weight of the ore, and to this may be added a small portion of decrepitated common salt. In the humid way, native tin may be dissolved in nitric acid, by which the tin is reduced to the state of white powder, which is an oxide of tin. If the ore be contaminated with iron or copper, these two metals remain in the solution.

Tin is of a white colour, little inferior in brilliancy to silver; the specific gravity is 7.29; it is so soft that it may be cut with a knife, or even scratched with the nail; and it is very flexible, giving out a peculiar noise when it is bent and folded. It is so malleable that it may be beaten out into very thin leaves; but it has little ductility or tenacity.

Tin melts at the temperature of 442°; and when it is allowed to cool slowly, it crystallizes in the form of large rhomboidal prisms. It is soon tarnished when exposed to the air, and assumes a greyish black colour; and when it is melted in an open vessel, a greyish pellicle is formed on the surface. When this pellicle is removed, another is formed, till the whole is converted into a grey powder; and if the heat be continued, the powder assumes a yellow colour. When tin is strongly heated, it is changed into a fine white powder, which gives out rapidly during the process a white flame. This oxide is condensed in the cold, and crystallizes in shining transparent needles.

Tin combines with two proportions of oxygen, and forms with it two oxides. The first, with the small proportion of oxygen, is the yellow oxide, which may be prepared by dissolving tin in nitric acid diluted with water; and without the aid of heat, by adding pure potash, the oxide is obtained in the form of a yellowish powder. This oxide, when first precipitated, and in combination with a portion of water, is white; but when the water is driven off by heat, it changes to dark grey. It is soluble in both alkalies and acids. It contains about 13 parts of oxygen in the 100 parts.

When tin is dissolved in concentrated nitric acid, the whole is converted with effervescence into a white powder, which falls to the bottom of the vessel. This oxide is supposed to contain double the proportion of oxygen which exists in the yellow oxide.

Tin combines readily with phosphorus, by projecting bits of the latter on the former while in fusion in a crucible. The phosphuret of tin which is thus obtained crystallizes on cooling, is of a silvery white colour, may be cut with a knife, and extended under the hammer. Under the action of the blow-pipe the phosphorus burns and is dissipated, and a small metallic button remains.

Sulphur unites readily with tin, by adding the sulphur to the metal in fusion; the compound is of a grey or bluish colour. has a metallic lustre, crystallizes in cubes or octohedrons, and is decomposed by the acids with effervescence. But if equal parts of sulphur and oxide of tin be fused together, sulphurous acid and some sulphur are given out, and a compound of a shining golden colour, which crystallizes in six-sided prisms, remains in the vessel. This compound is not acted on by the acids; when strongly heated it gives out sulphurous acid and sulphur, and sulphuret of tin, in the state of a black mass, remains behind. The compound formed by fusing oxide of tin and sulphur together, was supposed to be a sulphuretted oxide of tin, and was formerly called *mosaic gold*, *aurum musivum*, or *mosaicum;* but, from later experiments, it appears to consist of tin and sulphur, or a sulphuret of tin. Mosaic gold is in the form of light scales of a golden colour. It was formerly prepared by an expensive and tedious process; but it may be obtained either by the method already described, or by mixing together 12 parts of tin, 7 parts of sulphur, 3 parts of mercury, and 3 parts of sal ammoniac. This mixture is to be exposed to strong heat for eight hours in a black lead crucible, to which a cover is to be luted to receive the mosaic gold as it is sublimed. Tin.

Sulphate of tin.—Sulphuric acid acts slowly on tin in the cold; it is decomposed, its oxygen combines with the metal, and the oxide formed falls to the bottom in the state of white powder, while sulphurous acid gas is given out. The smaller proportion of oxygen exists in this oxide, the solution is more permanent, and no precipitation by water takes place; but if heat be employed in promoting the solution, the acid is still further decomposed, and the white oxide often is formed. This solution, when evaporated, assumes the form of a jelly, and is not crystallized by the addition of water.

Sulphite of tin.—Tin immersed in liquid sulphurous acid becomes first yellow and then black, while a black powder is precipitated. In this process a portion of the sulphurous acid is decomposed. Its oxygen unites with the metal, and forms an oxide, which combining with another portion of the acid, affords the sulphite of tin. The black powder is a sulphuret of tin.

Nitrate of tin.—The action of nitric acid on tin is extremely violent. Great heat is produced with a copious evolution of nitrous gas, and the metal is converted into a white oxide, which gives to the liquid the appearance of coagulated milk; but this solution is not permanent, for when it is concentrated by evaporation, the oxide is always separated.

But if diluted nitric acid be employed, and the heat be moderated by immersing the vessel in cold water, a small portion of the oxide of tin is dissolved. The tin is in the state of yellow oxide, and the solution is of a yellow colour. In this process the tin appears to be oxidated chiefly by the decomposition of the water, the hydrogen of which, uniting with the azote of the acid, forms ammonia, which appears during the decomposition of the water and the acid.

Muriate of tin.—Muriatic acid, when concentrated, dissolves tin; the acid is deprived of its fuming property and its yellow colour; a slight effervescence takes place, which is ascribed to the decomposition of the water and the evolution of hydrogen gas, which latter has a fetid odour, arising, it is supposed, from holding in solution a portion of the metal. No precipitate is formed in this solution as with the other acids; and by evaporation it furnishes deliquescent crystals, in the form of shining needle-shaped prisms.

The alkalies throw down a copious white oxide in the solution of muriate of tin; and with an excess of alkali this oxide is re-dissolved; the alkaline solution, which is of a brownish yellow colour, is precipitated by sulphuret of ammonia; a powder is deposited, which blackens as it dries, and yields by distillation ammonia and *aurum musivum*.

By means of nitric acid, oxymuriatic acid, or chlorine, the red oxide of mercury, the oxide of zinc and silver, and similar compounds containing oxygen, it is supposed that the muriate of tin, by combining with another portion of oxygen, is converted into the oxymuriate. A similar compound is supposed to be formed when the muriate of tin precipitates from the solution of gold the *purple powder of Cassius*.

The oxymuriate of tin is prepared directly by passing a current of oxymuriatic gas, or chlorine, into a solution of muriate of tin, or by triturating equal parts of an amalgam, consisting of two parts of tin and one of mercury and corrosive sublimate, and distilling the mixture in a glass retort with a very moderate heat. A colourless liquid first passes over, which is chiefly water, and is followed with the sudden evolution of a copious white vapour, which lines the inside of the receiver, and is condensed into a transparent liquid, which exhales when exposed to the air a heavy white vapour; from which property this liquid has been called the *smoking liquor of Libavius*. When this liquid is close shut up, it deposits on the surface needle-shaped crystals, which fall to the bottom, and remain unchanged. By the addition of one part of water to three parts of the fuming muriate of tin, the mixture is converted into a solid mass.

But according to the new doctrines of the nature of oxymuriatic acid, and the constitution of muriatic acid, the muriates of tin now described are compounds of chlorine and tin, or chlorides of tin, the first of which is composed of 100 parts of tin and about 61 parts of chlorine, and the second, or the *fuming liquor of Libavius*, consists of double the proportion of chlorine.

Tin combines with several other acids, as with arsenic, acetic, oxalic, and benzoic acids, some of which compounds are soluble in water, and afford crystals by evaporation.

Tin, in the metallic state, is little changed by the action of the alkalies; but its oxides readily combine with those bodies. The earths unite with the oxide of tin by fusion; and with the addition of a fixed alkali, an opaque vitreous mass, which is employed as an enamel, is obtained. Most of the salts are decomposed by means of tin; the nitrates, with the assistance of heat, produce deflagration; and muriate of ammonia undergoes a similar decomposition, to which, if sulphur be added, *aurum musivum* is formed. With four parts of muriate of ammonia, six parts of sulphur, eight parts of tin, and eight parts of mercury, a very beautiful *aurum musivum* may be prepared.

Alloys.—Tin readily unites by fusion with many of the other metals. With antimony an alloy is produced which is harder than the tin, and is employed in many of the arts, particularly for plates on which music is engraved. Tin and mercury readily combine in all proportions, especially when the combination is assisted by heat. The amalgam of tin and mercury is employed for covering mirrors. Zinc readily forms an alloy with tin by fusion, and the compound is a hard metal, the ductility of which corresponds to the quantity of tin. The alloy of tin and zinc forms part of the compound which is well known under the name of pewter.

Sect. XIII. *Zinc and its Combinations.*

As zinc forms part of the compound of the celebrated Corinthian brass, it is supposed that the Greeks were acquainted with that metal, but it seems doubtful whether they made any distinction between it and other metals. Some of its properties are alluded to by the alchemists of the 13th century, although it was near the middle of the 18th century before it was fully characterised as a distinct metal.

Zinc exists in nature in four different states—in the state of oxide called calamine; in the state of sulphuret, known by the name of blende, which is often crystallized; in the state of sulphate; and in that of carbonate, which dissolves with effervescence in nitric and muriatic acids.

The oxides of zinc are reduced by mixing the pulverized ore with charcoal, and heating the mixture in a crucible covered with a plate of copper. By this process the zinc is sublimed in the metallic state, and uniting with the copper converts it into brass; the intensity of the colour produced is regarded as a test of the richness of the ore; the sulphurets of zinc are deprived of their sulphur by roasting, and the residue is to be treated in the same way as the oxides.

Zinc is of a brilliant white colour, with a bluish shade, and of a lamellated texture. The specific gravity is nearly 7; it has a peculiar smell when rubbed between the fingers. Zinc is inferior in malleability to many of the other metals; but when it is heated to the temperature between boiling water and 300°, and hammered or laminated at that temperature, it acquires and retains a considerable degree of malleability and ductility; but it becomes brittle when it is exposed to the heat of 400°, and may then be reduced to powder. The tenacity of zinc is not great.

Zinc melts at the temperature of 680°, evaporates by increasing the heat, and may be distilled in close vessels. By slow cooling it crystallizes in the form of fine needles, which seem to be four sided prisms. Exposed to the air, zinc undergoes but little change; its lustre is soon tarnished; when it is kept in fusion in the open air, the surface is covered with a grey pellicle, which is an oxide of zinc; and by removing each pellicle as it is formed, the whole may be converted into the grey oxide. But if the metal be heated to redness in an open vessel it suddenly takes fire when the mass is stirred or agitated, and burns with a brilliant slightly greenish flame, and the zinc rises in the state of vapour, which being condensed in the air, appears in the form of light filamentous white flakes; this is an oxide of zinc, which has received different names from its peculiar properties—as flowers of zinc, white nothing, or philosophic wool. The proportions of this oxide are 80 parts of zinc and 20 of oxygen.

A phosphuret of zinc is prepared by adding small bits of phosphorus to zinc in fusion, but previously introducing a small portion of resinous matter to prevent the oxidation of the zinc; it is of a white colour, and metallic lustre; has some degree of malleability, gives out the odour of phosphorus when hammered, and burns like zinc.

Although blende, the native ore of zinc, is a compound of sulphur and zinc, or a true sulphuret, yet no artificial sulphuret has been obtained. But sulphur combines with the oxide, forming a sulphuretted oxide of zinc, which is of a grey colour, similar to the native sulphuret. According to the opinion of some chemists, the sulphur in this compound is united with zinc in the metallic state.

Sulphate of zinc.—Diluted sulphuric acid has a powerful action on zinc; a violent effervescence takes place, the mixture is strongly heated with the copious production of hydrogen gas. This process is usually followed to procure the hydrogen gas for chemical purposes. The water is decomposed, the oxygen of which combines with the metal and forms an oxide, which is dissolved in the sulphuric acid and forms a sulphate of zinc, while the hydrogen the other element of the water escapes in the state of gas. As the process proceeds, a white powder is deposited, and when the effervescence ceases it forms with water a transparent solution, which affords crystals by evaporation and cooling.

The crystals are in the form of four-sided flat prisms, terminated by four-sided pyramids. This salt has an acrid, astringent, and metallic taste; it is very soluble in boiling water, and when heated in a retort, melts, loses its water of crystallization, and, if the temperature be increased, is deprived of the greater part of its acid.

Sulphate of zinc is precipitated in the state of oxide by all the alkalies, and a white pigment is obtained by means of the carbonates; and the alkaline sulphurets and hydro-sulphurets, throw down a precipitate of a brown or deep orange colour. This salt is well known in commerce by the name of white vitriol; and as it is found in the shops it is in the form of white granular masses, having some resemblance to sugar, and often marked with yellow spots arising from a contamination of iron or copper. These metals may be precipitated by adding zinc filings to the solution; and the salt may be purified by repeated solutions and crystallizations.

Sulphite of zinc.—Sulphurous acid readily combines with the oxide of zinc without effervescence, but with the evolution of heat. The acid is deprived of its odour, crystals appear on the surface of the liquid, and the salt, which has a pungent acrid taste, is decomposed by the acids with effervescence, is insoluble in alcohol, forms white precipitates with the alkalies, and when exposed to the air is converted into the sulphate of zinc.

When sulphurous acid is added to zinc in a state of minute division, great heat is produced, sulphuretted hydrogen gas is evolved, and the liquid, at first brown and muddy, becomes yellow, and at last transparent. This solution has an acrid and sulphurous taste. Sulphuric and muriatic acids throw down a yellowish white precipitate, and disengage with effervescence sulphurous acid gas; and nitric acid at first separates sulphurous acid gas, and afterwards a flaky precipitate of pure sulphur. When this solution is exposed to the air, it assumes the consistence of honey, and affords crystals in the form of fine four-sided prisms, which are crystals of sulphuretted oxide of zinc, and which being exposed to the air are converted into a white powder, insoluble in water, but partially soluble in alcohol. The part which is not dissolved in alcohol gives out sulphurous acid gas by means of sulphuric acid, and the dissolved portion, beside sulphurous acid gas, affords a copious precipitate of sulphur.

Nitrate of zinc.—Nitric acid in a concentrated state, produces a violent action on zinc, and sometimes actually inflames it; but when the acid is diluted with water, the solution proceeds more moderately, although it is accompanied with great heat and with the evolution of nitrous gas. This solution is of a greenish yellow colour, very caustic, and affords by evaporation crystals in the form of four-sided, compressed, and striated prisms, terminated by four-sided pyramids. This salt is deliquescent in air, melts when it is heated on burning coals, and detonates with a small red flame. When it is heated in a crucible it gives out red vapour, and assumes a deep colour and a gelatinous consistence; and when it is cooled in this state, it retains its softness for some time. If the heat be continued the acid is decomposed, nitrous and oxygen gases are given out, and the oxide of zinc remains behind.

Muriate of zinc.—The action of muriatic acid and zinc is rapid and violent. Zinc is dissolved with effervescence, and with the evolution of pure hydrogen gas; and the solution, which is colourless, does not crystallize, but assumes the form of a transparent jelly. By distillation a small quantity of fuming acid appears, and a solid muriate of zinc, which melts with a moderate heat, and was formerly called *butter of zinc*, is produced. When this muriate of zinc is sublimed by heat it assumes a fine white colour, and is composed of a mass of crystals in the form of small prisms. It is decomposed by sulphuric acid, and is precipitated by the alkalies; is soluble in water, and when exposed to the air attracts moisture, and is soon converted into a transparent jelly.

But those who adopt the opinion that muriatic acid is a compound of chlorine and hydrogen, consider the muriate of zinc as a compound of chlorine and zinc; in this view the evolution of hydrogen gas, which takes place in the action of muriatic acid, is accounted for; and according to the analysis of this compound, it consists of equal proportions of chlorine and zinc.

Carbonate of zinc.—The carbonate of zinc, which is a natural production, may be formed artificially, by mixing zinc with water impregnated with carbonic acid; at the end of twenty-four hours the zinc is oxidated and dissolved in the water. When this solution is exposed to the air, it exhibits an iridescent pellicle of carbonate of zinc.

Arseniate of zinc.—If an alkaline arseniate be added to a solution of sulphate of zinc, a white precipitate, which is the arseniate of zinc, and is insoluble in water, is formed.

Acetate of zinc.—Zinc is dissolved by acetic acid, and the solution by evaporation affords crystals in the form of rhomboidal or hexagonal plates. This salt has a bitter metallic taste, remains unchanged in the air, is soluble in water, burns with a blue flame on red hot coals, and by distillation yields water, an inflammable liquid, and some oil. When the decomposition of the salt is completed, the oxide of zinc is sublimed, and when it is brought in contact with a candle it burns with a fine blue flame. The residue is in the state of pyrophorus, but it is not very combustible. This salt may be also formed by adding a solution of acetate of lead to a solution of sulphate of zinc.

The alkalies have a considerable effect on zinc. When it is immersed in a solution of potash it is tarnished and becomes black, and when it is boiled in the solution, hydrogen gas is evolved by the decomposition of the water. With ammonia the evolution of hydrogen gas is still more copious, and the solution of the oxide of zinc more abundant. When these alkaline solutions are exposed to the air, they become turbid in consequence of the carbonic acid combining with the oxide and being precipitated. With the aid of heat, the alkaline and earthy sulphates are readily decomposed by zinc. At a red heat the nitrates produce a vivid inflammation, accompanied with a violent explosion, in consequence of the sudden decomposition of the acid. The muriates are decomposed by zinc, and the phosphates and borates combine by fusion with its oxide, which communicates to the glass which is thus formed a greenish yellow colour. Most of the metallic salts are decomposed by means of zinc, and precipitated from their oxides, either in the state of oxide or in the metallic form.

Sect. XIV. *Antimony and its Combinations.*

Although it is supposed that antimony was employed by the ancients in the state of alloy with other metals, and in the form of oxide as an external application in inflammation of the eyes, yet it does not appear to have been known as a peculiar metal till the end of the 15th century, when Basil Valentine detailed in his *Currus triumphalis Antimonii*, a full history of what was then known of its properties. As antimony was regarded by the alchemists as essentially requisite to the success of their researches, their labours on this subject were unceasing, in the hope of making, by its means, the fortunate discovery of the *universal medicine.*

Antimony is found in nature in four different states; in the state of native antimony—of sulphuret—hydro-sulphuretted oxide—and muriate. To extract the pure metal from the sulphuret, which is the most common ore, it is first roasted to expel the greater part of the sulphur, and then mixed with its own weight of black flux, formed into a paste with oil, and exposed to strong heat in a crucible, at the bottom of which it is found reduced to the metallic state.

Antimony is of a brilliant white colour, of a lamellated texture, and exhibits some appearance of crystallization. The taste and smell are perceptible when it is rubbed on the hands; the specific gravity is 6.7; and it is so brittle that it may be easily reduced to powder. It possesses scarcely any malleability, and is inferior in tenacity to most other metals.

When it is heated to redness, which requires a temperature of 810° Fahrenheit, it melts, and by increasing the heat, rises in vapour. It is tarnished in the air, but suffers no other change; and when heated in an open vessel it absorbs oxygen, and appears in the form of white vapour, which being condensed forms the oxide of antimony, formerly denominated *argentine flowers of antimony.*

The investigation of the nature of the oxides of antimony seems to be attended with some difficulty, for even the accurate researches of modern chemistry have not been able to fix their number with precision. Some chemists reckon six oxides of antimony, while others limit the number to four or two. If antimony be dissolved in muriatic acid, and the solution diluted with water, a white precipitate is formed. This precipitate being washed with water, boiled for some time in a solution of carbonate of potash, again washed and dried on a filter, is of a dull white colour, and is an oxide of antimony, containing about 20 parts of oxygen and 100 parts of antimony. The white oxide of antimony is formed by subjecting the metal to strong heat in the open air, where it is sublimed in the state of *argentine flowers of antimony*, which is the oxide, containing about 30 parts of oxygen combined with 100 parts of the metal. Another oxide, with a larger proportion of oxygen, is obtained, by subjecting to strong heat metallic antimony reduced to powder, with six times its weight of nitre in a silver crucible. After the potash and nitre are washed off with water, a white powder remains, which, after being digested in muriatic acid, and again heated to expel the water, becomes of a light yellow colour, is insoluble in water, reddens vegetable blues, and is not soluble in acids. It is supposed to be composed of more than 37 parts of oxygen and 100 parts of metal. The white and the yellow oxides of antimony are considered by some chemists as possessing acid properties, analagous to some other metallic acids, and are called *antimonious* and *antimonic* acids. The yellow oxide was formerly distinguished by the name of *powder of algaroth.*

Antimony and phosphoric glass, with the addition of charcoal powder, being melted in a crucible, afford a phosphuret of antimony, which may be also formed by projecting phosphorus into the fused metal. This phosphuret has a metallic lustre, is brittle, and has a lamellated fracture.

Antimony readily enters into combination with sulphur, and forms with it an artificial sulphuret, which in its properties is analogous to the native sulphuret. It is formed by fusing together, in a crucible, the antimony and the sulphur; it is of a brilliant grey colour, more fusible than the metal itself, and crystallizes when it is slowly cooled. The proportions

Antimony.

of sulphur and antimony in this compound are estimated by different chemists from 30 to 35 parts of sulphur, and 100 parts of antimony.

With sulphuric acid the oxide of antimony seems not to have the property of forming a salt; but the acid is decomposed, and the antimony is converted into white oxide. A similar decomposition takes place with sulphurous acid. Nitric acid is rapidly decomposed by antimony, which is converted into the white oxide, a very small proportion of which combines with the acid.

Muriate of antimony.—Muriatic acid has a very feeble action on antimony; but with the white oxide it forms a colourless solution, which affords crystals in the form of shining plates; but nitro-muriatic acid dissolves antimony with more facility, and forms a colourless solution, and affords by evaporation a soft mass of a greyish white colour, which sometimes crystallizes in four-sided prisms. This muriate of antimony was formerly denominated *butter of antimony.* It is deliquescent in the air, very caustic and corrosive, and, when diluted with water, a white powder, which is the *powder of Algaroth,* is precipitated. When water is added to the solution, the salt is decomposed.

According to the new views of the constitution of muriatic acid, muriate of antimony is a compound of antimony and chlorine, or a chloride of antimony.

Phosphate of lime and antimony.—A triple salt is formed, by calcining together equal parts of the ashes of bones and sulphuret of antimony; or it may be prepared by dissolving white oxide of antimony and phosphate of lime in equal parts in muriatic acid, and then by adding this solution to a sufficient quantity of distilled water containing pure ammonia. By this process a precipitate is obtained in the state of white powder, which is nearly insoluble in water, and has been long employed in medicine as a diaphoretic and emetic, under the name of *James's powder.*

Tartrate of potash and antimony.—This triple salt, which is familiar under the name of *tartar emetic,* is prepared by mixing the white oxide of antimony with its own weight of tartar, and boiling the mixture in ten or twelve parts of water till the tartar be saturated. The solution being filtered and evaporated affords crystals of a white colour, and in the form of regular tetrahedrons. This salt effloresces in the air, is soluble in 80 parts of cold water, and in half that quantity at the boiling temperature, and is decomposed by heat, as well as by the alkalies and their carbonates.

The alkalies have a peculiar action on the sulphuret of antimony. One part of sulphuret of antimony, a sixteenth part of sulphur, and two parts of potash, mixed together, fused in a crucible, and poured into an iron mortar, and, after it is cool, being reduced to powder, boiled in water, and filtered, a reddish brown powder is deposited, which is called *Kermes mineral,* and appears to be a hydro-sulphuret of potash and antimony. Another substance remains in the solution, which is supposed to contain a larger proportion of sulphur, and has been called *golden sulphur.*

The oxide of antimony combines with some of the earths during their vitrification, and communicates to them different shades of yellow and orange colours.

Some of the neutral salts have a powerful action on antimony and its sulphurets. A mixture of two or three parts of nitrate of potash and one of antimony, in fine powder, and well rubbed together, produces a lively detonation. When projected into a red hot crucible, or thrown on burning coals, the antimony is strongly oxidated by the decomposition of the acid of the nitre. The residue of this detonation is a white scorified mass, which, after being washed with water, leaves a portion of the oxide of antimony in combination with the potash, in which case the oxide performs the part of an acid, and the compound, thus formed, crystallizes. The opinion, of the acid character of antimony in this state of combination, has been lately revived, or is rather announced as a new discovery. This antimoniate of potash is decomposed by the stronger acids, and the precipitate formed is an oxide of antimony, which was formerly called *ceruse of antimony,* and *magistery of diaphoretic antimony.*

Alloys.—Antimony enters into combination with most of the metals, and forms alloys with them, some of which are of great importance in the arts, and in particular the alloy formed with lead. When 16 parts of lead and one of antimony are fused together, the compound differs from lead only in hardness, has a greater specific gravity than the mean, and is employed in the fabrication of printer's types.

Sect. XV. *Bismuth and its Combinations.*

Bismuth.

Bismuth, it is supposed, was known to the ancients and some of the earlier mineralogists, but it was considered rather as a variety of some other metal, as of tin, lead, or antimony, than a peculiar metal, the properties of which were not fully ascertained till after the middle of the 18th century.

Bismuth exists in nature in three different states; it is found native, in the state of sulphuret, and in that of oxide. In the extraction of bismuth from its ores, the mineral being well washed, is to be mixed with about one-fourth of its weight of black flux, introduced into a crucible lined with charcoal, and well covered, and then to be exposed to a moderate heat, which must be quickly applied to prevent the sublimation of the metal. By this process, a metallic button is found at the bottom of the crucible. In the humid way, the ore of bismuth, after being reduced to powder, is to be dissolved in nitric acid, and precipitated from this solution by water, and any of the other metals which are alloyed with the bismuth remain in the solution. The sulphuret and native oxide are treated in the same way.

Bismuth is of a whitish yellow colour, and exhibits a lamellated texture; the specific gravity is 9.82.; it has no perceptible taste or smell; with a smart stroke of the hammer it is divided into small fragments: it has considerable hardness, but no ductility, and little elasticity; it is so fusible that it melts at 490, and by slow cooling crystallizes; with a strong heat in close vessels it sublimes, and crystallizes in brilliant plates in the upper part of the vessel.

Bismuth becomes tarnished in the air, and is covered with a yellowish grey powder, and when heat-

Bismuth. ed in contact with air, an iridescent pellicle appears on the surface, and by continuing the heat, is converted into a brown coloured oxide, which on agitating the fused metal assumes an orange-yellow colour. If the metal in fusion be subjected to a red heat, it takes fire, burns with a bluish flame, and is sublimed in the form of a yellowish vapour, which, being condensed, is denominated *flowers* of *bismuth*. This oxide of bismuth is insoluble in water, and has no taste; melts when strongly heated, and assumes a darker colour. It contains about ten parts of oxygen in the hundred parts of the oxide.

Bismuth seems scarcely to unite with phosphorus; but it combines readily with sulphur, and forms a sulphuret, which is of a bluish grey colour, and crystallizes in the form of four-sided needles.

Sulphate of bismuth.—With the aid of heat, sulphuric acid converts bismuth into a white powder, with the evolution of sulphurous acid gas. When the saline mass is washed with water, very little of the oxide remains in combination with the acid. When the solution is evaporated, it affords small crystals, which are not only insoluble in water, but are decomposed when brought into contact with that liquid, the oxide is precipitated and the acid combines with the water.

Nitrate of bismuth.—Concentrated nitric acid has a very violent action on bismuth; a strong effervescence with great heat, and the evolution of nitrous gas takes place. The bismuth is converted into white oxide in consequence of the decomposition of the acid; and if no addition of acid be made, the oxide remains in the state of dry powder. But if the acid be a little diluted, the oxide, as it is formed, is dissolved, and a colourless solution is obtained, which by evaporation affords crystals in the form of four-sided prisms. When this salt is brought into contact with water, it is decomposed, and a white oxide is precipitated; the same decomposition is effected, by gradually pouring the solution of nitrate of bismuth into a large quantity of water; the precipitate thus formed was formerly called *magistery of bismuth*, and is known in the shops as a paint under the name of *pearl white*.

Muriate of bismuth.—Muriatic acid in a concentrated state, and long digested with bismuth, converts it to powder; or if bismuth and corrosive sublimate be heated together, and kept in fusion for about two hours, at a temperature below the boiling point of mercury, the muriate of bismuth remains on the surface, and the mercury falls to the bottom. This muriate has somewhat of a granular texture, and is of a greyish white colour. But according to the new views of the constitution of muriatic acid, this salt is a chloride of bismuth, composed of about 66 parts of bismuth and 34 of chlorine.

The other saline compounds of bismuth, are not of sufficient importance to require any particular detail.

Bismuth is applied to many uses; it forms some important alloys with the softer metals, and gives them hardness and consistency. The oxide of bismuth is employed in the preparation of yellow enamels in the manufacture of porcelain, and it is mixed with the oxide of other metals to produce diversity of shade. It is also used to communicate a greenish yellow colour to glass. Manganese.

Sect. XVI. *Manganese and its Combinations.*

Manganese, from its peculiar properties, was suspected to be a distinct metal about the middle of the 18th century; and this point was fully ascertained by Scheele, Bergman, and Gahn about the year 1774. But it had been long employed in the manufacture of glass, and, from its property of purifying, or depriving glass of its colour, it was called *glass-maker's soap*.

Manganese is almost always found in nature in the state of oxide; and different ores are described, as the white, the red, and the black or brown ore of manganese. These varieties arise from different proportions of oxygen, or as they happen to be combined with other metallic or earthy matters; but the most common ore is the black oxide of manganese. It is obtained in the metallic state by reducing the native oxide to fine powder, and forming it into a paste with water. Part of this paste is to be made up into a ball, and introduced into a crucible lined with charcoal, while a thick stratum of charcoal is placed both below and above the ball of manganese. A second crucible, also filled with charcoal, is to be inverted over the other and luted to it, and the whole apparatus is to be subjected for more than an hour to a very intense heat, which ought not to be less than 160° of Wedgewood's pyrometer. After cooling, the metal is found in the form of globules in the midst of the scoriæ, or at the bottom of the crucible. But with too low a heat it is in grains.

The colour of manganese is greyish white, the texture is granular, and it has considerable brilliancy. The specific gravity is 6.8; it has neither taste nor smell; is one of the most brittle and most infusible of the metals, and is equal to iron in hardness. It is soon tarnished in the air, assumes different colours by the absorption of oxygen, and at last falls down into powder.

Three oxides of manganese have been discovered, called, from their colour, the green, the brown, and the black. Some chemists extend the number to five, and others with more probability limit them to two, the green and the black. The green oxide is prepared by immersing the metal for some time in water, by dissolving in acids, and precipitating the oxide by an alkali. It is the green oxide alone which combines with acids, and forms saline compounds. This oxide is composed of about 28 parts of oxygen, to the 100 parts of manganese. The black oxide, which is an abundant natural production, contains more than double the quantity of oxygen which exists in the green oxide. It is in consequence of this large proportion of oxygen, with which the black oxide of manganese is combined, that it is generally employed by chemists in the production of oxygen gas.

Phosphorus seems to enter into combination with manganese, and the compound is more fusible than the manganese itself. A sulphuret of manganese has also been formed, as well as a sulphuret of the oxide.

Sulphate of manganese.—Concentrated sulphuric acid acts on manganese, but its action is more powerful if the acid be diluted with two or three parts of water. The green oxide is readily dissolved by sulphuric acid, but without the aid of heat it has no effect on the black oxide. If the carbonate of manganese be dissolved in sulphuric acid, crystals in the form of silky needles are obtained. This salt, which is of a sweetish taste, is soluble in water, but insoluble in alcohol. This compound has been called the white sulphate of manganese. But if sulphuric acid be distilled from the black oxide of manganese, and the residue be washed in water, a reddish, or violet-coloured liquid, holding in solution another sulphate of manganese, is obtained. After evaporation, a gelatinous mass, in which some crystals appear, remains; and when the evaporation is carried on to dryness, saline crusts are formed on the surface, and successively fall to the bottom. This salt is very soluble in water, is decomposed by the alkalies, and precipitated in the form of red oxide. It is called the *red sulphate of manganese.*

Sulphurous acid deprives the black oxide of manganese of a portion of its oxygen, and is converted into sulphuric acid, which combines with the remaining oxide, and forms the sulphate of manganese.

Nitrate of manganese.—Nitric acid dissolves manganese with effervesence, and with the evolution of nitrous gas; but it has little action on the black oxide, except by long digestion, or by adding some vegetable matter, as honey, sugar, or oil, to deprive the oxide of part of its oxygen. A colourless solution is thus obtained, but it does not afford crystals. But a nitrate of manganese may be prepared by dissolving the carbonate in nitric acid, from which small needle-formed crystals may be obtained. This salt is white and semi-transparent, has a bitter taste, is very soluble in water, and is also soluble in alcohol, and deliquescent in the air.

Muriate of manganese.—Manganese is dissolved with effervesence in liquid muriatic acid, and with the evolution of hydrogen gas. The product is a white substance which has been called white muriate of manganese. But according to the new doctrine of the nature of muriatic acid, this salt is to be regarded as a compound of 54 parts of chlorine and 46 of manganese.

The other salts of manganese are of little importance. The pure alkalies favour the oxidation of manganese and the decomposition of water, because they combine readily with its oxide. When the fixed alkalies are fused with manganese, they form a mass of a deep green colour, which is soluble in water, and communicates to it the same colour. When this solution is kept in close vessels, a yellowish oxide of iron is precipitated, and the green oxide becomes blue. The alkaline solution is precipitated by water, and becomes first of a violet, and then of a red colour; and as the particles of the oxide collect together, the liquid becomes white. The same changes of colour, and the same precipitate, are formed by the addition of a few drops of acid, or by exposing the solution to the air. This compound has been called *mineral cameleon,* from the various changes of colour which it undergoes.

Sect. XVII. *Nickel and its Combinations.*

Nickel is mentioned about the end of the 17th century, under the name of false copper; but it was not till the middle of the 18th century, when it was examined by Cronstedt, that it was announced as a distinct metal.

Nickel, as it is found in nature, is usually in the state of sulphuret, which has some resemblance to tarnished copper. It is also met with alloyed with iron, and in the state of oxide, which is of a bright green colour. To extract it from its ores, they are first roasted to expel the sulphur and arsenic, and the roasted ore being mixed with two parts of black flux, is introduced into a crucible covered with common salt, and subjected to a forge heat. A metallic button is found at the bottom of the crucible.

Nickel is of a yellowish, or reddish white colour, and of a granular texture; the specific gravity is 8.2, and it has some degree of malleability, for it may be hammered out into thin plates. It possesses magnetic virtue, and is little inferior in this property to iron. It is very infusible, and is not changed by exposure to the air; but is soon tarnished when heated, passing through various changes of colour, like steel treated in the same way. If nickel be dissolved in nitric acid, and precipitated by potash, the oxide dried and heated to redness, is of a blackish ash grey colour, and contains about 27 parts of oxygen and 100 parts of metal. A black oxide of nickel is formed by passing a current of oxymuriatic or chlorine gas through water in which the grey oxide is diffused. Part of the oxide is dissolved, and the remainder assumes a black colour, which is the oxide of nickel, containing 44 parts of oxygen and 100 of the metal. The black oxide is soluble in acids with effervescence, in consequence of part of its oxygen being separated to reduce it to the state of grey oxide, which only is soluble in the acids, and forms solutions of a green colour.

A phosphuret of nickel is prepared by fusing together phosphoric glass, charcoal, and nickel. The compound has considerable lustre, is of a tin white colour, possesses moderate hardness, and is very brittle.

Nickel also readily combines with sulphur by fusion, and the sulphuret is of a yellowish colour, hard, and in small brilliant facets.

Sulphate of nickel.—With the aid of heat, concentrated sulphuric acid is decomposed by nickel. Sulphurous acid gas is given out, and a grey mass remains, which is soluble in water, and communicates to it a fine green colour. By evaporation, crystals of a pale emerald green colour, in the form of square prisms, are formed.

Nitrate of nickel.—Nitric acid also oxidates and dissolves nickel with the assistance of heat, and the oxide is dissolved without effervesence; the solution is of a blackish green colour, and affords rhomboidal crystals, which are deliquescent in the air. But if the air be warm and dry, both the water of crystallization and the acid separate, and leave behind only an oxide of the metal.

Acetate of nickel.—Acetic acid dissolves the oxide of nickel, and forms with it a salt of a deep green colour.

Nickel, it is supposed, might be usefully employed in the fabrication of enamels, and for colouring glass, pottery, and porcelain, and indeed it is conjectured that it is already applied to some of these purposes.

Cobalt.

Sect. XVIII. *Cobalt and its Combinations.*

Cobalt was first extracted from its ores by Brandt, a Swedish chemist, about the year 1732; but it seems to have been employed to give a blue colour to glass after the middle of the 16th century.

Cobalt exists in nature in the state of alloy with arsenic, or in combination with sulphur and arsenic, in the state of black oxide, or forming a compound with arsenic acid, and called *cobalt bloom*, or *flowers of cobalt*.

To extract the pure metal from the ores of cobalt, the mineral, after being roasted, is to be mixed with three times its own weight of black flux and a little common salt, and the mixture being introduced into a crucible lined with charcoal, is to be exposed to a forge heat. When the fusion is completed it is necessary to agitate the crucible, to collect the detached metallic globules into one mass. If the ore contain bismuth, two metallic buttons are found under the vitreous scoriæ; the bismuth, which is the heaviest, occupies the lowest place.

Cobalt is of a reddish grey colour, of a fine granular texture, very brittle, and easily reduced to powder; and its specific gravity is from 7.81 to 815. It is one of the most infusible metals, and requires a temperature equal to 130° of Wedgewood for its fusion; it becomes red before it melts, and crystallizes by slow cooling. Like iron and nickel, cobalt is attracted by the magnet.

Cobalt is not altered by exposure to the air, but when it is kept for some time at a red heat in an open vessel, it is converted into a powder, which passes through various shades of blue, and at last becomes of a very intense blue or black colour; and with a more violent heat, the oxide which is thus formed is fused into a bluish black glass. It seems to enter into combination with oxygen in two different proportions, and forms with it two oxides. When the solution of cobalt in nitric acid is precipitated by potash, the oxide thrown down is of a blue colour, and becomes black by the absorption of oxygen, as it dries in the open air. This black powder being exposed to strong heat is deprived of a portion of its oxygen, and then assumes a fine blue colour. This blue oxide, which is composed of about 27 parts of oxygen and 100 parts of metal, dissolves in the acids without effervescence. The black oxide, which is formed by exposing the blue oxide to the air, consists of nearly 37 parts of oxygen and 100 parts of cobalt, and it dissolves with effervescence in muriatic acid.

A phosphuret of cobalt is formed, which is more fusible than the pure metal; and by fusing the metal with sulphur, in combination with potash, a sulphuret of a yellowish white colour, which can only be decomposed by means of the acids, is obtained.

Sulphate of cobalt.—At the boiling temperature, concentrated sulphuric acid dissolves cobalt; a reddish grey mass which is soluble in water is obtained, and the solution, which is red, affords by evaporation crystals in the form of rhomboidal prisms. This salt is decomposed by heat.

Nitrate of cobalt.—With the assistance of a moderate heat, nitric acid dissolves cobalt, and the red coloured solution affords small prismatic crystals which are of the same colour, are deliquescent in the air, are decomposed when placed on burning coals, and leave behind a deep red oxide. This salt is decomposed by the alkalies, and the oxide of cobalt thus obtained is employed in the fabrication of enamels, and for giving colour to porcelain.

Triple salts are formed both with the sulphate and nitrate of cobalt, and the alkalies.

Muriate of cobalt.—Muriatic acid when heated dissolves cobalt, and the solution of the black oxide in the same acid is accompanied with effervescence. The concentrated solution of muriate of cobalt is of a fine green colour, which changes to red when water is added. By evaporation, small crystals, which are deliquescent in the air, are obtained. The solution of these crystals in water, which should be diluted till the colour nearly disappears, forms one of the first known sympathetic inks. When characters are marked on paper with this solution, they are invisible in the cold, but when heated assume a fine green colour. These changes may be often repeated, if too much heat be not applied. This curious change is ascribed by some to the absorption and dissipation of the moisture of the atmosphere, and by others to a partial separation of oxygen by heat, and to its re-absorption in the cold.

Cobalt combines with some other acids; the acetate is formed by dissolving the oxide in acetic acid. The solution is of a blue colour when it is heated, but is red in the cold, so that it is a kind of sympathetic ink.

Some of the earths combine with the oxide of cobalt. Silica, with a fixed alkali, forms with this oxide a beautiful blue-coloured glass, the intensity of which depends on the quantity of oxide employed.

In the metallic state, cobalt is scarcely applied to any useful purpose. Zaffre is used for coarse enamels and pottery ware, but the purer oxides of cobalt are selected for the purposes of porcelain; and azure, which is a vitreous blue substance in the state of fine powder, is prepared for similar purposes. Zaffre being fused with silica and an alkali, forms a deep blue glass, which is known in commerce by the name of smalt. This glass being reduced to powder, is diffused in a great quantity of water. The first portion which precipitates is called coarse azure; and in this way four different quantities, having different degrees of fineness, are separated.

Arsenic.

Sect. XIX. *Arsenic and its Combinations.*

Arsenic in the state of sulphuret, which is a reddish coloured mineral, was employed by the ancients as a paint, but it was not distinctly ascertained to be a metallic substance till the middle of the 17th century.

Arsenic is found native, in dark coloured masses, which have little brilliancy, and, excepting at the fracture, have no metallic lustre. It is frequently combined with other metals, as with iron, when it is called *arsenical pyrites* or *mispickel*; and often in combination with sulphur, when it is known under the names of *orpiment*, which is yellow, and *realgar* which is red; and more rarely in the state of white oxide.

Arsenic.

Arsenic is easily detected in its different states of combination, by throwing a little of it on red hot coals. The white fumes which arise, and the garlic smell which is emitted, afford sufficient indications of this metal. To extract the metal from its oxide, it is to be mixed with three times its weight of black flux; the mixture, introduced into a crucible, to which another crucible inverted is adapted and luted, and heat being applied to the lower crucible till it become red, the metal is sublimed, and attaches itself in the form of crystals to the inside of the upper crucible.

Arsenic is in the form of small plates, of a bluish white colour, and with considerable lustre; the specific gravity is 5.7; it is very brittle, and is easily reduced to powder; it has no perceptible taste or smell in the cold, but when heated gives out the fetid odour of garlic. It is soon tarnished in the air, becomes first yellowish, then black, loses its hardness, and becomes very friable. When it is heated in contact with air, it is sublimed in the form of a white acrid soluble mass, which is the white oxide of arsenic, or the *white arsenic* of the shops. This compound is the *arsenious acid* of chemists; it reddens vegetable blues, and is extremely acrid and caustic, so that it is one of the most virulent poisons. It consists of about 32 parts of oxygen and 100 parts of metal; but this acid combines with another portion of oxygen, and forms arsenic acid, which may be prepared by dissolving the arsenic of the shops in nitric acid, and evaporating the solution to dryness. This acid is composed of about 53 parts of oxygen and 100 parts of metal.

Arsenic readily enters into combination with phosphorus, and the compound may be formed, by distilling, with a moderate heat, equal parts of phosphorus and arsenic. The phosphuret thus obtained is of a dark colour, brilliant, and burns on red-hot coals, with a mixed odour of arsenic and phosphorus. This phosphuret must be preserved under water. The same compound may be prepared, by boiling together, in water, phosphorus and arsenic; as the phosphorus melts it combines with the arsenic.

Arsenic combines readily with sulphur, either by fusion or by sublimation, and a compound of a red or yellow colour is obtained. It is prepared by heating together white arsenic and sulphur; but if white arsenic be dissolved in muriatic acid, and a solution of sulphuretted hydrogen gas in water be added, a yellow coloured powder, called *orpiment*, falls to the bottom. The same compound may be prepared by subliming arsenic and sulphur at a temperature below what is requisite for their fusion. Orpiment is supposed by some to contain a smaller proportion of sulphur than realgar. But, according to others, the diversity of appearance is ascribed to a mechanical mixture of a certain portion of arsenious or arsenic acid with the sulphuret.

Sulphate of arsenic.—Concentrated sulphuric acid, boiled with arsenic, produces effervescence with the evolution of sulphurous acid gas; the arsenic is oxidated and precipitated in the form of white powder. By evaporating the solution, the white oxide of arsenic falls to the bottom, and sulphuric acid remains in the solution nearly in a state of purity.

Nitric acid is rapidly decomposed by means of arsenic; the metal is oxidated, and, with the addition of a new portion of acid, is converted to the state of arsenic acid, but no nitrate is formed.

Muriate of arsenic.—The compound of muriatic acid and the oxide of arsenic, is considered, by those who adopt the new opinions of the constitution of muriatic acid, as a chloride of arsenic, consisting of chlorine and metallic arsenic. It may be prepared by mixing together six parts of corrosive sublimate and one part of arsenic, and distilling the mixture in a retort with a moderate heat. The product which passes over is a transparent liquid of the consistence of oil, and hence called butter of arsenic. It is very volatile, and is decomposed by the addition of water. The white oxide, or arsenious acid, is precipitated.

In the state of white oxide arsenic is a good deal employed in the arts; and it is alloyed with some of the metals to give them new properties, by which they are more fusible, and are thus rendered susceptible of being converted into different instruments and utensils. To counteract the effects of arsenic, when it happens to be taken into the stomach, water, impregnated with sulphuretted hydrogen gas, and some of the alkaline sulphurets, dissolved in water, are recommended as the best antidotes.

SECT. XX. *Tungsten and its Combinations.*

Tungsten.

The name of tungsten is derived from a white transparent mineral, which is composed of this metal in the state of acid combined with lime. Its metallic properties were discovered about 1781 by Messrs D'Elhuyart, two Spanish chemists, who detected the same metal in the mineral called wolfram, in which the acid is combined with manganese and iron.

To decompose the acid and to extract the metal, it is mixed with charcoal powder, and subjected in a crucible to the strongest heat. A mass is found at the bottom of the crucible, partly composed of small metallic globules, and partly of a dark-brown friable powder.

This metal is of a greyish-white colour, with considerable brilliancy, and has some resemblance to steel; is one of the hardest of the metals, and one of the heaviest; its specific gravity is 17.4; it is very difficult of fusion.

When tungsten is heated in an open vessel, it is converted into an oxide, and seems to combine with two different proportions of oxygen. These oxides, from their colour, are called the brown and the yellow; the latter of which, from its peculiar properties, is denominated tungstic acid.

The yellow oxide, or tungstic acid, is prepared by boiling together three parts of muriatic acid and one part of wolfram. The acid being decanted off in about half an hour, and allowed to remain at rest, lets fall a yellow powder, which being dissolved in ammonia, and the solution being evaporated to dryness, the dry mass, after being subjected to a red heat, is the pure yellow oxide, or tungstic acid.

Tungsten unites with phosphorus and sulphur, forming a phosphuret and sulphuret. It forms alloys

Molybdena. with many of the metals; and tungstic acid unites with the alkalies, earths, and metallic oxides, and forms with them saline compounds.

Sect. XXI. *Molybdena and its Combinations.*

About the year 1778, Scheele obtained from the mineral called sulphuret of molybdena, an acid substance, which Bergman conjectured to be a metallic oxide; and by the researches of Pelletier, it was established that the base of this acid is a peculiar metal, and that the mineral is a compound of this metal and sulphur.

Molybdena has only been met with in combination with sulphur; and the metal is extracted from the ore by repeatedly roasting the sulphuret with a moderate red heat till it is reduced to the state of powder. This powder being dissolved in ammonia, and the solution being filtered, is to be evaporated to dryness; and the dry mass, with the addition of a little nitric acid, being moderately heated, leaves behind an oxide of molybdena in the form of white powder. This powder, mixed with charcoal, or oil, and exposed to a very strong heat, is deprived of its oxygen, and reduced to the metallic state. But the metal is only in the state of small grains, which appear to be brittle, with some degree of brilliancy, and of a whitish colour, with a shade of yellow; the specific gravity is from 7.4 to 8.6.

When molybdena is exposed to heat in an open vessel, it is gradually oxidated. Three oxides of molybdena are described. The brown oxide is prepared by exposing the sulphuret of molybdena to heat in the open air till the sulphur is dissipated, and the metal is converted into molybdic acid, which being dissolved in ammonia, the solution evaporated to dryness, and the dry mass introduced into a crucible, and covered with charcoal powder, after being exposed to a white heat, leaves behind, at the bottom of the vessel, a mass of a crystalline appearance, which is the brown oxide. The blue oxide is prepared by mixing together one part of the metal in powder, and two parts of the white oxide, and triturating, in a porcelain mortar, the mixture made into a paste with hot water till it become blue, and after adding eight or ten parts of water, boiling the whole for a few minutes. This solution being filtered, and evaporated with a very gentle heat, a fine blue powder remains, which is the blue oxide. The white oxide, or molybdic acid, is prepared by roasting the sulphuret, dissolving the residue in ammonia, and adding nitric acid, which precipitates the molybdic acid in the form of fine white scales, which become yellow by fusion and sublimation.

Molybdena enters into combination with phosphorus and sulphur, forming with them a phosphuret and sulphuret; the latter of which is the only combination of the metal hitherto found native.

Molybdena forms alloys with many of the metals. With the acids it forms solutions, which are generally of a blue colour, but do not crystallize; and molybdic acid forms compounds with the alkalies, earths, and metallic oxides.

Sect. XXII. *Chromium and its Combinations.*

Chromium was discovered by Vauquelin in 1797, in the red lead ore of Siberia. One part of the ore being boiled with two of carbonate of potash in 200 parts of water, the carbonic acid of the potash unites with the lead, while the potash combines with an acid substance, which is the other constituent part of the ore, and remaining in the solution, the salt is decomposed by nitric acid, which combines with the potash, and the oxide of chromium, which is in the state of acid, is precipitated. This oxide, being strongly heated with charcoal, affords the metal to which the name of chromium has been given, on account of its peculiar property of communicating colour to all its saline compounds.

Chromium is of a greyish white colour, very brittle, and requiring a very high temperature for its fusion. The specific gravity is 5.9. It possesses some degree of magnetic property.

Chromium remains unchanged in the air; but when it is heated in contact with the atmosphere, it is converted into an oxide; and as it unites with three different proportions of oxygen, three oxides, the green, the brown, and the yellow oxide, or chromic acid, are formed.

The green oxide is prepared by exposing chromic acid to heat in close vessels; a partial decomposition of the acid takes place, and part of the oxygen being driven off, the green oxide remains behind. The brown oxide is obtained by dissolving the green oxide in nitric acid, evaporating the solution to dryness, and heating the dry mass till no more nitrous gas is given out. A shining powder of a brown colour remains, which is not soluble in the acids, and very sparingly by means of the alkalies. The yellow oxide or chromic acid is of a deep red colour, with a sharp metallic taste, is soluble in water, and affords crystals of a ruby colour. Chromic acid is supposed to contain double the quantity of oxygen which exists in the green oxide. This acid combines with the alkalies, earths, and metallic oxides, and forms with them saline compounds called *chromates*. It is found in nature combined with lead and iron.

Sect. XXIII. *Titanium and its Combinations.*

Titanium. Titanium was discovered by Klaproth in 1793; he extracted it from the mineral called red schorl, which is an oxide of titanium. But, two years before this period, Mr Gregor had detected a similar oxide in a black sand, found in the valley of Menachan in Cornwall. He gave the supposed new metal the name of *menachine*, but he was not successful in reducing it.

This metal has been found only in the state of oxide, and it is usually crystallized and disseminated in rock crystal or quartz. To extract the metal from the red oxide, 100 parts, with 50 parts of calcined borax, and 50 of charcoal, are made into a paste with oil, and subjected to a forge heat, equal to 166° of Wedgewood. By this process, a dark coloured mass, somewhat agglutinated, and having a brilliant appearance on the surface, is obtained. This metal, which has been procured only in very small quantities, is of a reddish yellow colour; is one of the most infusible of the metals; is soon tarnished in the air, and with the assistance of heat is readily oxidated. It seems to combine with three proportions of oxygen. The blue or purple oxide is obtained when the metal

Tellurium. is exposed to heat in the open air; the red oxide is a natural production, and is the red schorl of mineralogists; and the white oxide is prepared by fusing the red oxide with four times its weight of potash in a crucible, and dissolving the fused mass in water; the white powder which precipitates is the white oxide.

The phosphuret of titanium has been formed; but this metal has not yet been combined with sulphur.

Sulphuric and nitric acids dissolve the carbonate of titanium. The solution of the former does not crystallize, but transparent crystals are obtained from the solution of the latter.

Sect. XXIV. *Tellurium.*

About the year 1782, it was conjectured that the gold ore called paradoxical or problematical gold, contained a peculiar metal, but this conjecture was only verified in 1798 by Klaproth, who gave the new metal the name of tellurium. It has been since found in four different ores of gold; white gold ore, in which it is combined with iron and gold; graphic gold ore, which is composed of tellurium, gold, and silver; yellow gold ore, a compound of tellurium, gold, silver, and sulphur; and grey gold ore, which is considered as a variety of the last, with the addition of a small portion of copper.

To extract the metal from the ore, a portion of it is slightly heated with six parts of muriatic acid, and after adding three parts of nitric acid the solution is to be boiled, the whole is dissolved with effervescence, and the solution, being diluted with water, is to be mixed with a solution of caustic potash to dissolve the precipitate. A brown flaky matter, composed of the oxides of gold and iron, only remains. The alkaline solution of the oxide of tellurium is to be mixed with muriatic acid to saturate the potash, when a copious heavy white powder is deposited. This powder is then made into a paste with oil, and heated to redness in a small glass retort. By this process the metal is partly sublimed at the upper part of the retort, and partly fused and crystallized at the bottom.

Tellurium has some resemblance to lead, has considerable lustre, and is very brittle; it has a lamellated texture like antimony, and by slow cooling exhibits a crystalline form on the surface. The specific gravity is 6.11; it is one of the most fusible of the metals; it boils readily when heated in close vessels, and is sublimed in the form of brilliant globules, which adhere to the upper part of the vessel.

Tellurium is supposed to combine with oxygen only in one proportion. When the metal is dissolved in nitro-muriatic acid, and the solution is copiously diluted with water, a white powder is precipitated, which is the oxide of tellurium. The same oxide is formed, by subjecting tellurium to the action of the blow-pipe on charcoal; the metal burns with a blue flame and rises in white vapour, the odour of which has been compared to the smell of radishes. This white vapour is the oxide of tellurium, which, being heated in a retort, is converted into a straw-coloured mass, which on cooling assumes a radiated texture. When this oxide is heated on charcoal, it is so rapidly reduced that the process is accompanied with a kind of explosion. It is composed of 20 parts of oxygen, and 100 parts of the metal. The oxide of tellurium seems, in certain cases, to perform the part of an acid.

Tantalium. Tellurium combines with hydrogen gas, and forms a transparent colourless elastic fluid, which has a peculiar odour, is soluble in water, to which it communicates a claret colour, and burns with a bluish flame, while it deposits the oxide of the metal.

Sulphate of tellurium.—If one part of tellurium be mixed with 100 parts of concentrated sulphuric acid in a close vessel in the cold, the liquid becomes of a beautiful crimson colour, if water be gradually added to the solution, the colour disappears, and the metal is deposited in the form of black flakes, or, if the solution be heated, the colour also vanishes, and the oxide is thrown down in the state of white powder. But if diluted sulphuric acid be employed, with the addition of a small portion of nitric acid, the tellurium is more copiously dissolved, the solution is transparent and colourless, and is not decomposed by water.

Nitrate of Tellurium, &c.—Tellurium is dissolved in nitric acid, and forms with it a transparent colourless solution, which by evaporation affords small needle-formed crystals; and nitro-muriatic acid forms also with tellurium a solution which is precipitated by adding water, and the white powder which is thrown down is soluble in muriatic acid.

The solutions of tellurium in the acids, are precipitated in the form of yellow coloured flakes.

The pure alkalies precipitate the saline solutions of tellurium in the form of white oxide, and with an excess of alkali the precipitate is redissolved.

Sect. XXV. *Tantalium or Columbium.*

A new metal was detected by Mr Hatchett in 1802, in a mineral from North America. To this metal the name of Columbium was given; and it appears that one of its oxides has acid properties. Columbium forms saline compounds with the acids. A metallic substance was also extracted from two minerals, one of which was called by Ekeberg, the discoverer, *tantalite*, and the other *yttro-tantalite*, because it contained a portion of the earth of yttria.

Sect. XXVI. *Uranium.*

Uranium was discovered by Klaproth in 1789. It has been extracted from three mineral substances, pitch blende, oxide of uranium, and green mica or glimmer, which is a carbonate of uranium. Uranium is of a dark grey, and internally of a pale brown colour; has little brilliancy; may be scratched with a knife, and is extremely infusible; the specific gravity is 6.4; it undergoes no change in the air, or when it is acted on by the blow-pipe. The native yellow oxide does not melt, but acquires a brownish grey colour when it is long heated in contact with the air.

The yellow oxide is readily dissolved in the acids, and the nitrate of uranium forms the most beautiful of all the metallic salts.

Sect. XXVII. *Cerium.*

A mineral substance, which is found in a coppermine in Sweden, has been long a subject of investigation among chemists. It was at first supposed to contain the metal called tungsten; it was examined by Klaproth, and from his analysis he concluded that it contained a new earth, which he called *ochroit*. From the analysis of the Swedish chemists, Hisinger and Berzelius, it was inferred that the mineral is impregnated with a metallic oxide, and this metal they called *cerium*, from the planet Ceres. It has been found extremely difficult to reduce the oxide of cerium; and, even in the latest experiments which have been made on the subject, it is supposed that the carburet only has been obtained. Cerium seems to combine with two proportions of oxygen, and thus to form two oxides. It forms saline compounds with the acids, and both of its oxides enter into combination with sulphur. The solutions of the salts of cerium in water have a sweetish taste, and they are not precipitated by the infusion of nut galls.

Atmosphere.

PART II. PHENOMENA OF NATURE.

Having in the former part detailed the Chemical History of Individual Substances, arranged in groups or classes, and possessing some common properties, we are now prepared to apply the knowledge thus acquired to the examination of objects as they are presented to us by nature; and in the prosecution of this plan, it may be convenient to divide the whole into five Chapters, under which will be considered, I. The Atmosphere; II. The Waters; III. Minerals; IV. Vegetables; and V. Animals.

Chapter I. Of the Atmosphere.

The atmosphere is that invisible elastic fluid which surrounds the earth. Its physical properties have been long known; but the nature of its chemical constitution is to be regarded as the result of the labours of modern philosophers. The chief part of the history of the atmosphere belongs to Meteorology, but, in the present chapter, it is proposed to take a short view of the composition and changes to which it is subject.

Sect. I. *Composition of the Atmosphere.*

The air of the atmosphere, which was considered by the ancients as one of the four elements of which all matter is composed, was still regarded as a simple homogeneous substance till the discovery of oxygen and azotic gases, which are its chief ingredients.

The air of the atmosphere, which is often called common air, possesses all the physical properties of the different kinds of air which have come under examination. It is invisible and elastic, and is susceptible of indefinite expansion and compression; 100 cubic inches weigh 31 grains at ordinary temperature and pressure.

After the discovery of the composition of atmospheric air, it became an object with chemical philosophers to ascertain the proportions of its constituent parts. It was observed by those who were engaged in these researches, that the oxygen gas of the atmosphere only is absorbed in those changes which certain bodies undergo when they are exposed to its action; and on this principle depends the construction of the instruments called *Eudiometers*, or measurers of the goodness of the air, or of that proportion of oxygen which it contains, and which is essential to the function of respiration. For this purpose different instruments have been proposed, but all of them depend on the same principle, namely, the abstraction of the oxygen gas from agiven portion of ai r

The first kind of eudiometer was proposed by Dr Priestley. That philosopher had observed, that nitrous gas brought into contact with atmospherical air, combining with its oxygen, is converted into nitric acid, and he thought that it might be conveniently applied to ascertain the quantity of oxygen gas in any given portion of atmospheric air. But the results from this kind of eudiometer being subject to variation from the difference of purity of the gas employed, the water over which the experiment is made, and even the form of the apparatus, were not constant and uniform.

Scheele proposed a mixture of iron filings and sulphur, formed into a paste with water, which mixture, as it absorbs the whole of the oxygen gas of any given portion of atmospheric air, would indicate by the diminution of bulk the proportion of oxygen gas which it contains. But as this process goes on slowly, this eudiometer was improved by the substitution of hydroguretted sulphuret of potash, or lime, for the iron filings and sulphur. This mixture is prepared by boiling together sulphur and lime water, or sulphur and a solution of potash and water. In the application of this kind of eudiometer, a given portion of air is agitated in a bottle with this mixture, taking care at the same time to exclude the external air with a well ground stopper, and the diminution of bulk of the air subjected to the experiment, which takes place in a few minutes, shews the proportion of oxygen gas.

The explosion of hydrogen gas in a given portion of atmospheric air, by means of the electric spark, was proposed by Volta, as an indication of the proportion of oxygen gas in any given quantity of air. But the accuracy of this experiment depends on the nice adjustment of the quantity of hydrogen gas employed. Phosphorus, which readily absorbs the oxygen of the atmosphere, and is converted into phosphorous acid, was first proposed by Achard, and improved by Berthollet. The green sulphate, or muriate of iron, dissolved in water, and impregnated with nitrous gas, has been proposed by Sir H. Davy, for the purpose of a eudiometer. The apparatus required is a small graduated tube, divided into 100 parts, and widest at the open end, and another vessel for containing the liquid. The tube being filled with the air to be examined, is introduced into the solution; and to promote the absorption, it is gently moved from the perpendicular to the horizontal position. The experiment is completed in a few minutes; but it is necessary to watch the moment at which the diminution of bulk stops, when the whole of the oxygen is condensed by the nitrous gas in the solution, in the form of nitric acid; for after this the volume of gas remaining is increased by the decomposition of the nitric acid, by the action of the green oxide of iron.

From numerous experiments made with different eudiometers, as well as from other experiments on air in different places, and collected under different circumstances, it appears that the constituent parts of the air of the atmosphere are always very nearly in the same proportion; and these proportions are 21 parts of oxygen gas, and 79 of azotic gas, in 100 parts of the air by bulk.

It cannot be doubted that water exists in the atmosphere; and to indicate its presence, and ascertain its proportions, instruments called hygrometers, or measurers of moisture, have been contrived; but none of these instruments yet proposed, is susceptible of any great degree of accuracy; for much diversity of opinion still prevails with regard to the quantity of water in the atmosphere. A difference of opinion also prevails, whether this water exists in the atmosphere in the state of water, or has been converted into vapour. According to the first opinion, the water is held in solution by the air, and as the temperature of the air is raised its solvent power is increased. But it is the opinion of others, that the water in the atmosphere is in the state of vapour, and the amount varying at different seasons of the year, and in different climates, is from one sixtieth to one three hundredth part of the weight of the atmosphere.

Carbonic acid is always found in the atmosphere, as is indicated by lime water, or an alkaline solution which is exposed to the air, being soon covered with a crust, in consequence of the conversion of the lime or alkali into the state of carbonate. The quantity of carbonic acid is found to vary from a hundredth to a thousandth part.

The component parts of the atmosphere being azotic gas, oxygen gas, water, and carbonic acid gas, a question has been agitated among chemical philosophers, whether these ingredients are in a state of chemical combination, or of mechanical mixture.—The proportion of oxygen and azotic gases which is invariably found to be the same in all places, whether on the surface of the earth, or at great heights in the atmosphere, over the land, or over the ocean, in the arid desart, or in the midst of the most crowded population, and at all seasons of the year, seems to afford ample confirmation of the former opinion.

Sect. II. *Changes of the Atmosphere.*

The changes in the state of the atmosphere, with regard to its temperature, its pressure, and the water or vapour, in whatever state it exists, are too obvious to escape observation; but it is only by the help of instruments, which are the invention of modern times, that these changes could be marked with any degree of accuracy.

Temperature.—Considering the variable temperature of the same day in the same place, in winter and summer, and of different climates, it might seem almost impossible to discover any general law according to which so many insulated facts might be arranged.

In considering this remarkable diversity of temperature, which is observed in different places, and at different periods, it became an object with naturalists to find out certain fixed points from which the whole amount of the changes for any given period might be ascertained. This was first suggested by Mayer of Gottingen, who proposed the method adopted by astronomers of finding the mean of certain large periods, as for years or months; and he made the fortunate discovery, by which the mean annual temperature of two latitudes being determined, the mean annual temperature for every other degree of latitude may be also found. This rule was greatly improved and extended by the ingenuity and industry of Mr Kirwan; and upon this principle, tables, exhibiting the mean annual temperature for all degrees of latitude, from the equator to the poles, were constructed by that philosopher. What is called a standard situation, that is, a place where the uniformity and constancy of the temperature are least affected by adventitious causes, being first found from observation, the temperature of every other situation was compared with it. This standard situation selected by Mr Kirwan, is the immense tract of the Atlantic and Pacific oceans, which comprehends a large proportion of the surface of the globe. But for the method of constructing the tables, the reader is referred to Mr Kirwan's *Essay on Temperature.*

The difference of temperature within ten degrees of the equator, and within the same distance from the poles is very small, and the variation of temperature for different years within the same space is also observed to be very little. But the difference of temperature is greater as the distance increases from the equator towards the poles. The standard annual temperature at the equator is 84°, and at the poles it is 31°, and in the intermediate latitude of 45° the mean annual temperature is 57.5, or the mean between the two extremes. The air is not heated by the action of the sun's rays as they pass through it, but by reflection from the earth; and hence it happens that the temperature decreases with the elevation above the earth; the greatest cold prevails in the highest regions of the atmosphere, and lofty mountains, even under the equator, are covered with perpetual snow. At a certain height, which varies in every latitude, it freezes every night in all seasons. This height which is observed to be at 15,577 feet within the tropics, is called the *lower term of congelation*; but at still greater heights, as the vapours do not reach that elevation, it never freezes at all. This height is denominated the *upper term of congelation.* Under the equator this point is estimated at 28,000 feet.

As land and water have different capacities for receiving, retaining, and giving out heat, great diversity prevails in the temperature of the air over land and over water. At the depth of 80 or 90 feet below the surface of the earth, the temperature is subject to little variation, and it generally approaches to the mean annual temperature. The heat of springs which contain a considerable body of water, and are not superficial, which would subject them to the variations which take place near the surface of the earth, corresponds with the mean annual temperature of the climate.

Pressure.—The pressure of the air, which is indicated by the barometer, is also subject to considerable variation. At the level of the sea the mean height of the barometer is greatest, because the column of air which supports the mercury in the tube is longest; and although subject to variations, as well as at other heights, the average height is about 30 inches. The pressure of the air on the surface of the earth, is equal to about 15 pounds on every square inch. In all places within the tropics, the variations of the barometer are observed to be smallest, and in elevated situations the variations are still smaller than at the level of the sea. In the neighbourhood of the poles, the deviations of the mercury from its mean annual altitude are greater than at the equator; and they are greater and more frequent without the tropics in winter than in summer. Changes of temperature, velocity of currents of air, and the agency of vapours, are assigned as the causes of these variations in the pressure of the atmosphere.

Winds.—The winds present another change in the state of the atmosphere. At first sight they seem subject to great irregularity; but in some parts of the world they are pretty regular and uniform. As the action of the sun's rays is greatest within the tropics, the mean annual temperature is highest in the equatorial regions; and as the air in these regions is subject to the greatest degree of rarifaction, a current of denser and colder air rushes in from the north, and another from the south, to restore the equilibrium. But as the earth has a diurnal motion from west to east, the current of air which proceeds from the north seems to proceed from the north-east; and the current of air from the south, from the south-east; constituting, from their steadiness and uniformity, the north-east and south-east *trade winds.*

But the uniformity of the trade winds is interrupted by the unequal effects of land and water, in heating the atmosphere. As the air over land is more heated through the day, it suffers a greater degree of rarifaction, and therefore the current of air rushes in to restore the equilibrium—and hence the sea breeze which prevails during the day in the islands between the tropics; but during the night the air over water is most rarified, and occasions the land wind which blows during the night.

While the sun is in the northern tropic, the air over the extensive continent of Asia is more rarified than the air over the great Indian ocean; and hence the latter rushing in to restore the equilibrium, continues to blow for six months of the year, and constitutes the south-east *monsoon.* But when the sun is in the southern tropic, the air over the ocean is most rarified; and the current of denser air rushing from the north produces the north-west *monsoon,* which blows during the other half of the year.

Aqueous vapours.—The vapour which ascends into the atmosphere is subject to various changes. In the state of vapour it exists in the form of an invisible elastic fluid, it appears in the form of clouds which float in the air, or it falls to the earth in the form of dew, rain, snow, or hail—changes which arise from variations of temperature, or from the quantity of heat with which it is combined, although with some probability they are also ascribed to the effects of electrical agency.

The invisible vapour, after being subjected to certain changes, is converted into what is called vesicular vapour, because it is composed of small vesicles, or hollow spheres, which were found by Saussure, who first observed them, to be highly electrified, and which seem to form a kind of middle state between invisible vapour and water. A collection of these vesicles constitutes clouds, the form, the appearance, and the height of which, although extremely diversified, Mr Howard has attempted to reduce to a system.

The fall of dew is most copious during the night, from which it is inferred that the invisible vapour which ascends into the atmosphere through the day, being deprived of its heat, is again converted into the state of vapour.

As the invisible vapour, when it assumes the form of vesicular vapour, becomes visible, and as the clouds are composed of collections of vesicular vapour, these clouds having undergone some farther change are dissolved in rain. The formation of rain has been ascribed by some to the mixture of clouds at different temperatures, by which their capacity for holding the same quantity of water in solution is diminished; but by others it is supposed that it may be traced to the effects of electricity, which may contribute to this change of capacity, or in some more direct way to its production. As the quantity of vapour which exists in the atmosphere, and the quantity of dew that falls in different regions of the globe are very different, so the quantity of rain varies greatly in different places. The greatest quantity of rain falls within the torrid zone, and the quantity is diminished in proportion to the distance from the equator towards the poles. The annual fall of rain at the island of Grenada, in north latitude 12°, is 120 inches, while at Petersburgh, nearly in north latitude 59°, it is not more than 16 inches.

Snow, which is composed of small shining crystallized spiculæ, diverging from a centre, is another form which the vapours of the atmosphere assume; and clouds of snow are supposed to be similar to clouds of rain, excepting in being deprived of heat, and being frozen. The formation of hail is ascribed to the sudden diminution of temperature and the freezing of the drops of rain in their progress towards the earth. Hailstones are white pellucid solid bodies, are sometimes angular, thin, or flat, and sometimes of a round or pyramidal form. After a copious fall of dew, and by a sudden diminution of temperature, the water deposited on the surface of the earth appears in the form of hoar-frost, which is an assemblage of small parcels of crystals of ice, arranged and distributed in various ways, according to the degree or suddeness of the change of temperature.

Chapter II. Of Waters.

The constituent parts of water, which are oxygen and hydrogen, and the different states in which it exists, as in the solid state, or that of ice, in the liquid state, and in the state of vapour, have been already treated of. Water was then considered in a state of purity, but as it is found in nature this is seldom the case; for even rain water, which is the purest, is contaminated with substances which float in the air before it fall to the earth, and waters which flow on the surface of the earth, or are carried through the strata under the surface, are impregnated with various soluble matters, with which they come in contact in their progress. The saline and peculiarly nauseous taste of sea-water, are too striking to escape observation; and the peculiar qualities of mineral waters are obvious to the senses. The waters possessed of such distinctive properties become the subjects of chemical investigation; and in this view they have been divided into *sea water and mineral waters*.

Sect. I. *Sea-water.*

The saline taste of sea-water is chiefly derived from the common salt which it holds in solution, while the nauseous taste, which is considered in some measure foreign to it, is ascribed to animal and vegetable matters. These matters are only found in sea-water which is taken up at the surface of the ocean or near the shores. The specific gravity of sea water, which is greater than that of common water, from the saline ingredients dissolved in it, varies from 1.0269 to 1.0285; and it is owing to the same saline ingredients that it is not frozen till the temperature is reduced to 28°.

Muriate of soda, or common salt, muriate of magnesia, sulphate of magnesia, sulphate of lime, and soda, are the principal salts found in sea water. The whole amount of saline ingredients in the waters of the ocean, varies from one twenty-fourth to one twenty-second part; but even these proportions are different in the same latitude during the rainy and dry seasons of the year, near the land or the mouths of great rivers. The difference of latitude seems not to produce any considerable difference in the proportion of saline matter. It appears from tables constructed by observing the specific gravity of sea water in different latitudes, that the proportion of saline matter is greatest near the tropics. It is smaller at the equator, which is supposed to be owing to the greater quantity of rain that usually falls on that part of the globe.

Sect. II. *Mineral Waters.*

The name of mineral waters is given to such waters as are perceptibly distinguished by the smell, taste, or colour, from pure water. The peculiar properties which mineral waters possess are derived from the soluble substances with which they combine in their passage through the soil or strata of the earth. The effects of such waters on the animal economy attracted the notice of mankind, and led to their use in the cure of diseases. Mineral waters are divided into four classes, 1. *acidulous*, or *gaseous waters; 2. saline waters; 3. sulphureous*, or *hepatic waters; and, 4. chalybeate waters.*

Acidulous waters have a penetrating acid taste, boil with facility, sparkle when they are poured into a glass, and when agitated give out bubbles of air. Such waters are generally impregnated with carbonic acid, they redden the tincture of turnsole, and precipitate lime-water

The taste is sufficiently characteristic of *saline waters*, and this taste is different, as might be expected, according to the nature of the salt with which they are impregnated.

The *sulphureous waters* are distinguished by a fœtid odour, which resembles that of rotten eggs, or the washings of a gun, and by blackening lead and silver, In some of these waters, the sulphuretted hydrogen gas is held in solution by the water, and in others it is combined with lime or with an alkali.

The *chalybeate waters*, which constitute the fourth class, have an astringent taste, and give a blue colour with the prussiate of lime, or a black with the infusion of nut-galls. The iron, to which these effects are owing, is held in solution either by carbonic or sulphuric acid, and when the carbonic acid happens to be in excess, the water has a penetrating taste, with a slight degree of acidity.

1. *Ingredients found in Mineral Waters.*

The substances which have been detected in mineral waters belong either to the gaseous bodies, acids, alkalies, earths, or salts.

Among the gaseous bodies found in mineral waters, oxygen gas is generally in small proportion; and it does not exist in waters with sulphuretted hydrogen gas or iron. Azotic gas has been discovered in the waters of Buxton, Harrowgate, and some others, and a certain portion of common air is usually present. Fixed air, or carbonic acid, exists in variable proportions in most mineral waters. The proportions are from 6 to 40 cubic inches in 100 of the water, and in some more than its own bulk. The quantity of sulphuretted hydrogen gas, to which the sulphureous waters owe their peculiar properties is also variable.

Of the acids in mineral waters, sulphuric acid is always combined with other substances; sulphurous acid is met with in some hot mineral springs in the neighbourhood of volcanoes; muriatic acid is always in combination with other matters; nitric acid is said to exist in a combined state in mineral waters in Hungary; and boracic acid has been discovered in a separate state in some lakes in Italy.

In the state of carbonate, the alkalies are not unfrequent in mineral waters; but they are rarely found uncombined. Soda was detected in the hot mineral springs of Iceland. The earths are generally in a state of combination in mineral waters. Silica was discovered in the hot springs of Iceland, and it has been found in some other waters.

The saline substances which are held in solution by mineral waters are the sulphates, nitrates, muriates, and carbonates.

The sulphate of soda is not unusual in the waters of springs and lakes. Sulphate of ammonia is met with in mineral waters in the vicinity of volcanoes. Sulphate of lime is common in most springs. Epsom salt is frequent in many mineral waters; alum and sulphate of iron are not unfrequent; and sulphate of copper has been only detected in the waters that flow from copper-mines.

The nitrates are not common in mineral waters. Nitre has been detected in some springs in Hungary. Springs in the deserts of Arabia contain nitrate of lime; and nitrate of magnesia is said to have been found in some mineral waters.

Muriate of soda, or common salt, is rarely absent from waters which are accounted tolerably pure. Muriate of ammonia is not frequent, although it has been traced in the waters of some lakes of Italy and Siberia; but muriate of lime is common in mineral springs, and muriate of magnesia is also common. Some traces of muriate of manganese have been observed in some mineral springs in Sweden, and in the waters of Lemington Priors in England.

The carbonate of potash has been found, it is said, in some mineral waters. Carbonate of soda is frequent in springs and lakes. Carbonate of ammonia exists in the waters of Rathbone Place in London, and in some waters in France. Carbonate of lime, held in solution by an excess of carbonic acid, is usual in most waters; and carbonate of magnesia is also frequent in mineral waters. Carbonate of iron, to which chalybeate waters owe their characteristic property, is frequent in mineral waters.

The lakes of Thibet and Persia furnish the borax of commerce. Sulphureous waters derive their peculiar properties from the hydro-sulphurets of soda or of lime; and bituminous substances, sometimes in combination with an alkali, have been met with in some mineral waters.

2. *Analysis of Mineral Waters.*

In the examination of mineral waters, the situation of the springs, their temperature, colour, transparency, smell, taste, and specific gravity, require first to be attended to. By means of the specific gravity, the total amount of the saline ingredients may be nearly ascertained; but it is only by chemical processes that the nature of the substances with which mineral waters are impregnated can be determined.

Method of discovering the substances in mineral waters.—The nature of the substances which are held in solution by mineral waters, is detected by means of tests, or re-agents, which enter into combination with them, and form new compounds.

Gaseous substances are known to exist in mineral waters by their escape in the form of bubbles when exposed to the air, or by boiling a quantity of the water, and receiving the gas, which is expelled, over water or mercury, and subjecting it, after being thus collected, to the usual tests of gases. The infusion of litmus is a convenient test for uncombined carbonic acid, and saturated lime-water may be employed with the same view. With the latter test the water becomes muddy, and with the former it is reddened; but this colour disappears when the water is boiled, in consequence of the escape of the carbonic acid. The infusion of litmus is also employed as a test for mineral acids; and when such acids are present, the red colour is permanent. Sulphuretted hydrogen gas reddens the infusion of litmus, and communicates a black colour to silver or lead, as well as to the solutions of these salts. But it is easy to detect this gas by its peculiar odour. Carbonated hydrogen gas has no peculiar smell, burns with common air without explosion, and is not absorbed by lime-water.

The fixed alkalies, as well as the alkaline and earthy carbonates, give a brown colour with the infusion of turmeric, and a blue with that of Brazil wood; and paper, stained with litmus, and reddened with vinegar, has its original blue colour restored. Muriate of magnesia is precipitated only by the fixed alkalies; and potash affords, with nitric acid, a prismatic salt; with acetic acid a salt which is not deliquescent, and with sulphuric acid an efflorescent salt. Ammonia indicates its presence by the smell; and if it be in small proportion, it may be detected by distilling a portion of the water with a moderate heat.

The carbonates of the earths and metals are usually precipitated, merely by exposing the water to the air, or by boiling and evaporation. The carbonates of lime, alumina, and iron, are precipitated by boiling for a quarter of an hour; but the carbonate of magnesia is only partially precipitated.

Iron, in every state of combination in which it is met with in mineral waters, is indicated by a black or purple colour produced by tincture of galls, and a blue colour appears with the addition of prussiate of potash.

The muriate, nitrate, or acetate of barytes, and nitrate, or acetate of lead, are convenient tests of sulphuric acid, with the bases of which that acid forms insoluble compounds. Muriatic acid is easily detected by nitrate of silver, with the base of which a whitish cloud or precipitate is formed, and boracic acid, when it is uncombined, is detected by acetate of lead.

Oxalic acid is an excellent test of lime; and barytes is detected by diluted sulphuric acid. Magnesia and alumina are both precipitated by means of pure ammonia and lime water; but if the water contain any carbonic acid, it must be previously separated by a fixed alkali, and by boiling. If lime water be employed, the sulphuric acid must first be precipitated by means of nitrate of barytes, and if the two earths be precipitated together, the alumina may be separated from the magnesia by boiling with pure potash, which combines with the alumina. Siliceous earth is discovered by evaporating a large quantity of the water nearly to dryness, redissolving the precipitate in nitric or sulphuric acid, and then evaporating to dryness. The dry mass being dissolved in water and filtered, leaves the siliceous earth on the filter.

Sulphate of soda is discovered by separating ammonia by gentle distillation, and then by evaporating to one half, adding lime water, while any precipitate is formed. By this process all the other sulphates are thrown down, and by farther evaporation, and the addition of a few drops of alcohol and oxalic acid, the whole of the lime is separated. To the residue, after filtration, add a strong solution of nitrate of lime, with which a precipitate appears, even with a very minute portion of any of the alkaline sulphates. By evaporating a portion of the water, the sulphate of lime is deposited. Carbonate of lime is the test for alum, with which it forms a precipitate, and the sulphates of the metals are thrown down by means of an alkaline prussiate.

The hydrosulphuret of strontites, which gives no immediate precipitate with any other salt, is a good test for sulphate of magnesia; but it is necessary that the water should be previously free from any excess of acid. To detect the muriate of potash, or of soda, the sulphates, if any exist in the water, must be first separated, which may be done by means of alcohol and nitrate of barytes. The earthy nitrates and muriates are decomposed by diluted sulphuric

Mineral Waters.

acid, and the nitric and muriatic acids are driven off by heat. Alcohol and barytic water separate the salts which are formed with sulphuric acid, so that nothing remains in the water but alkaline nitrates and muriates. The muriates are decomposed by acetate of silver; and if a precipitate be thus formed, the water contains muriate of potash or of soda. The acetate of potash is a deliquescent salt, and the acetate of soda effloresces.

Muriate of ammonia is discovered, by first separating the sulphates by acetate of barytes, and then evaporating the solution to dryness. The dry mass can only consist of acetates and alkaline muriates, and being dissolved in alcohol, and allowed to remain for 24 hours at the temperature of 60°, all the salts except the alkaline muriates are dissolved, and the residue distilled with quick lime gives out ammonia. Muriate of barytes, the only saline compound of this earth yet observed in mineral waters, is detected by sulphuric acid. To detect the muriate of lime, the sulphate of lime is first separated by evaporating the water to a few ounces, and then adding alcohol, and afterwards nitrate of barytes. The filtered solution is then to be evaporated to dryness, and the dry mass being dissolved in alcohol, is again evaporated to dryness, and the residue is dissolved in water. If a precipitate be formed in this solution, by adding nitrate of silver, oxalic or sulphuric acid, muriate of lime may be expected in the water, and if, by carbonate of lime added to a portion of the solution, alumina is precipitated, the muriate of alumina may exist in the water, but not muriate or nitrate of magnesia. Pure ammonia precipitates magnesia from its combination with nitric or muriatic acid; but if none of these earths appear, the muriatic acid detected in the water must have been in combination with lime.

Muriate of magnesia may be discovered, by decomposing the sulphates by means of the nitrate of barytes, and the solution being filtered, evaporated to dryness, and the residue dissolved in alcohol, the latter solution is evaporated to dryness, and the dry mass dissolved in water. This solution can only contain the nitrates of lime and magnesia, and the muriates of lime, and alumina. Carbonate of lime precipitates alumina, pure ammonia throws down magnesia, and muriatic acid is detected by nitrate of silver.* To discover whether the muriatic acid be united to magnesia, treat another portion of the solution with sulphuric acid and alcohol; and if no alumina have been found, and no precipitate appear, magnesia is the only earth retained in the solution.

The muriates of alumina and iron are detected by first saturating the alkaline carbonates if they exist in the water, and decomposing the sulphates by means of nitrate of barytes; the addition of carbonate of lime to a portion of the filtered water precipitates the muriates of alumina and iron. Carbonate of lime also separates muriate of manganese.

The nitrates of potash and of soda are discovered by precipitating the sulphates with acetate of barytes, and the muriates with acetate of silver. The solution is then evaporated to dryness, and the residue being dissolved in alcohol, the alkaline nitrates, and a portion of acetate of lime, remain undissolved. Let the undissolved nitrates be separated, washed with alcohol, and redissolved in water. The nitrate of lime is decomposed by carbonate of magnesia; and the nitrate of magnesia thus formed, may be separated by evaporating the solution to dryness, and adding alcohol to the dried mass. The nitrate of magnesia is dissolved, but the alkaline nitrates are not acted on. To discover nitrate of lime, evaporate the water considerably, that any sulphate of lime which it may contain may be deposited, and add alcohol to separate the other sulphates. The sulphates being filtered off, and the alcohol expelled by heat, oxalic acid added to the solution produces a precipitate if it contain any lime. The muriates being decomposed with acetate of silver, the solution filtered and evaporated to dryness, the dry mass being dissolved in alcohol, and the latter solution being evaporated to dryness, and what remains being redissolved in water, if nitrate of lime be held in solution it may be detected by sulphuric acid.

Nitrate of magnesia is discovered by first separating the sulphates and muriates, filtering the solution, evaporating to dryness, and dissolving the residue in alcohol. This solution being again evaporated to dryness, and what remains being dissolved in water, pure potash being added to the solution precipitates the earthy acetates and the nitrate of magnesia. The solution is then filtered, evaporated to dryness, and the residue being treated with alcohol, the alkaline acetates are dissolved, but the nitrate of potash remains untouched. From the results of this process, it appears that nitrate of magnesia previously existed in the water.

The following is a list of saline substances, which are incompatible with each other, or which cannot exist together in the same water.

1. Alkaline carbonates are incompatible with earthy or metallic sulphates, muriates, or nitrates, that is, a decomposition would take place, or they could not remain in the same state of combination.

2. Sulphuric acid is incompatible with the earthy nitrates, muriates, or carbonates.

3. Alkaline sulphates are incompatible with earthy nitrates or muriates.

4. Sulphate of soda is incompatible with the muriate of potash.

5. Sulphate of potash is incompatible with nitrate of soda.

6. Sulphate of ammonia is incompatible with nitrate of potash and muriate of potash.

7. Sulphate of magnesia is incompatible with nitrate or muriate of lime.

8. Alum is incompatible with nitrate of lime, and of magnesia, or with muriate of magnesia.

9. Nitrate of lime is incompatible with muriate of potash, muriate of ammonia, of barytes, or of magnesia.

10. Nitrate of magnesia is incompatible with muriate of barytes, and of potash.

11. Muriate of magnesia is incompatible with nitrate of soda or of lime.

3. *Method of ascertaining the proportions of Substances in Mineral Waters.*

The physical properties of a mineral water, are first to be attended to, and especially the specific gravity, from which the quantity of saline matter may be estimated. The method recommended by Mr Kirwan, is to subtract 1000, the specific gravity of pure or distilled water, from the specific gravity of the mineral water uuder examination, expressed in whole numbers, and then to multiply the product by 1.4, which gives the weight of the salts free from their water of crystallization. Thus, if the specific gravity of a solution of common salt be 1.079, and if 1000 be subtracted from this number, 79 remains, which being multiplied by 1.4 gives a product of 110.6; and this latter number indicates the quantity of saline matter in 1000 parts of the solution. But the whole amount of saline ingredients, in any mineral water, may be more directly ascertained by evaporating a determined portion of it to dryness, and weighing the dried mass. To insure the utmost degree of accuracy, the process of evaporation ought to be very slowly conducted.

The physical properties being ascertained, and the quantity or the whole amount of the saline ingredients being determined, the next point is to estimate the quantity of gaseous bodies with which the water is impregnated. This is to be effected by heating a determined quantity of the water in a retort, and collecting the elastic fluid as it escapes over water or mercury, according to its nature, which is to be discovered by the different tests already alluded to, and the proportion is to be estimated by calculating the bulk; in doing which, the proper allowance is to be made for the difference of temperature and pressure of the air of the atmosphere.

The proportion of the carbonates is next to be estimated; but if the water contain sulphuretted hydrogen, this gas must be first separated by exposure to the air for some time, or by treating it with litharge; a quantity of the water is then to be filtered and boiled for half an hour, and in this way it is deprived of the earthy or metallic carbonates, if the water be impregnated with no sulphuretted hydrogen gas. It is then to be boiled for a quarter of an hour, exposed to the air till it is cool, and filtered. The earthy carbonates, which may be carbonate of lime, of magnesia, and of alumina, and the carbonate of iron, as well as the sulphate of lime, remain on the filter. Let this precipitate be dissolved in diluted muriatic acid, in which the whole, except the alumina and sulphate of lime, is soluble. After subjecting the residue to a red heat, estimate the weight, and boil it in carbonate of soda; saturate the soda with muriatic acid, and after boiling the mixture for half an hour, carbonate of lime and alumina are precipitated; and this precipitate being dried and treated with acetic acid, the lime is dissolved, but the alumina remains. The weight of the lime, after being dried, subtracted from the original weight, gives the proportion of sulphate of lime.

To separate the iron, add ammonia to the muriatic solution, as long as a reddish precipitate is formed. If magnesia be thrown down with the iron, expose the precipitate in the open air for some time to a heat of 200°; add acetic acid in small quantities to dissolve the magnesia; and the iron being thus separated, is to be redissolved in muriatic acid, precipitated by an alkaline carbonate, dried in a moderate heat, and weighed. The acetate of magnesia is next to be precipitated, and the amount estimated; and the muriatic solution being freed from iron and part of the magnesia, let sulphuric acid be added as long as any precipitate is formed; and let the solution be then heated slightly. In this way the sulphate of lime is separated; and when it is heated to redness and weighed, 100 grains correspond to 70 grains of dried carbonate of lime. The magnesia is next to be precipitated by carbonate of soda, dried, and weighed; but as the whole of the carbonate of magnesia is not precipitated by boiling, the water is to be evaporated nearly to dryness. The carbonate of magnesia and sulphate of lime are deposited. Add a large quantity of boiling distilled water to dissolve the sulphate of lime and other substances; and the carbonate of magnesia which remains behind is to be collected, dried, and weighed. The quantity of carbonate of alumina and sulphate of lime, after being subjected to a red heat, is to be estimated by ascertaining their weight.

The proportion of sulphuric acid is determined by adding barytic water to saturation, and weighing the precipitate after exposing it to a red heat. One hundred parts of sulphate of barytes contain 33 parts of real sulphuric acid. The proportion of muriatic acid may be also determined by adding barytic water till it is neutralized, and then precipitating the barytes with sulphuric acid. One hundred parts of barytes take up 31.8 of real muriatic acid. By another process, the muriatic acid is precipitated by nitrate of silver; and the precipitate being dried and weighed, indicates for every 100 parts 25.2 parts of muriatic acid. Boracic acid is precipitated by acetate of lead, and the precipitate being digested with sulphuric acid in a heat of 200° for an hour, the solution is to be evaporated to dryness, and the dried mass being dissolved in ten or twelve times its weight of alcohol, and distilled, the boracic acid remains behind.

The proportion of alkaline carbonates in a mineral water is estimated by saturating them with sulphuric acid, and marking the weight of real acid which is required. For 120 parts of potash and 80 parts of soda, 100 parts of real sulphuric acid are required for their saturation.

The alkaline sulphates are precipitated by nitrate of barytes, and 170 parts of ignited sulphate of barytes indicate 100 of dried sulphate of soda; and 137 parts of sulphate of barytes correspond with 100 of dry sulphate of potash.

Sulphate of lime is most conveniently ascertained by evaporating to a few ounces, and adding a little alcohol, which precipitates the sulphate, the amount of which, after being dried, is to be weighed. The proportion of alum is ascertained by evaporating a quantity of the water to one half, and precipitating with carbonate of lime. Acetic acid added to the precipitate takes up the excess of lime, and the alumina thus freed from the carbonate of lime, and heated to incandescence for half an hour, twelve parts denote 100 parts of crystallized alum, or nearly 49 of the dried salt.

If the water be freed from other sulphates, sulphate of magnesia is estimated by precipitating the acid with a barytic salt, and 100 grains of sulphate of barytes indicate 52 of sulphate of magnesia; but if the water contain sulphate of lime without any other sulphate, it is decomposed by carbonate of magnesia, and the precipitate thus obtained being weighed, determines the quantity of sulphate of lime; the whole of the sulphuric acid is precipitated by barytes, and thus its quantity may be estimated, and then by subtracting the quantity of sulphuric acid in the sulphate of lime, the remaining portion indicates what was in combination with the magnesia.

If sulphate of soda be detected in a mineral water, none of the earthy nitrates or muriates can exist along with it; and if no other earthy sulphate has been discovered, the magnesia is to be precipitated by means of soda, dried and weighed, and 33 parts indicate 100 parts of dried sulphate of magnesia. But if sulphate of lime accompany the two sulphates, the precipitate, which consists of lime and magnesia, being dissolved in suphuric acid, evaporated to dryness, and again dissolved in twice its weight of cold water, the sulphate of magnesia remains in the solution, and the sulphate of lime is insoluble. The sulphate of magnesia is to be evaporated to dryness, exposed to a heat of 400°, and weighed. If the water contain alum instead of sulphate of lime, a similar process may be adopted; but the precipitate being dried, is first to be treated with acetic acid to dissolve the magnesia, while the alumina remains untouched. Sulphate of iron is separated by exposing the water for some days to the air, and then adding alumina. The iron is precipitated in the state of oxide, and the sulphate of alumina, which is insoluble, is at the same time precipitated. The iron and alumina being thus previously saturated, the proportion of sulphate of magnesia may be estimated in the way which has been already described.

The proportion of sulphate of iron is estimated by weighing the precipitate formed with prussiate of potash, in a solution of a known weight of sulphate of iron in water, which has been previously ascertained, and then by precipitating the sulphate of iron in the water with the same prussiate; but if muriate of iron be detected in the water, which seldom happens, the liquid is to be evaporated to dryness, and alcohol being added to the residue, the muriate is dissolved, but the sulphate is insoluble.

The muriates of potash or of soda, when no other salts are held in solution, are estimated by precipitating with nitrate of silver; and 217.65 parts of muriate of silver denote 100 of muriate of potash; 235 parts denote 100 of muriate of soda. If the water contain any of the alkaline carbonates, they are to be previously separated by saturating with sulphuric acid; and the muriatic acid may then be precipitated by sulphate of silver. Muriate of ammonia is decomposed by barytic water, the ammonia is expelled by boiling, and the barytes is precipitated by sulphuric acid, while the muriatic acid is saturated with soda, and the sulphate of barytes indicates the quantity of muriate of ammonia, of which 45.5 parts are indicated by 100 parts of sulphate of barytes.

If the common salt be accompanied with the muriates of lime, of magnesia, of alumina, or of iron, they may be precipitated with barytic water, and each of the earths being washed, but not dried, is to be re-dissolved in muriatic acid. If only one of these salts be found, let the excess of acid be saturated with a known quantity of an earth of the same kind, and let the solution be evaporated to dryness. The weight of the muriate formed by the earth added, is then to be deducted from the weight; thus 50 parts of lime denote 100 of muriate of lime heated to redness; 31 parts of magnesia denote 100 of muriate of magnesia, and 21.8 parts of alumina indicate 100 parts of muriate of alumina. The barytes is precipitated by means of sulphuric acid, and the muriatic acid is expelled by heat. The muriate of soda may then be estimated by evaporation. But the proportion of common salt which the known quantity of muriatic acid, separated from the earths, denotes, must be deducted.

When sulphates and muriates accompany each other, the sulphates may be precipitated by alcohol, or by evaporating the whole to dryness; the earthy muriates may then be dissolved in alcohol; sulphate of lime accompanying alkaline and earthy muriates, is decomposed by muriate of barytes, and the precipitate of sulphate of barytes indicates the proportion of sulphate of lime.

When the muriates of soda, magnesia, and alumina accompany the sulphate of lime and magnesia, the water to be examined is to be divided into two equal portions; to the one portion add carbonate of magnesia to precipitate the whole of the lime and alumina, and by precipitating the sulphuric acid by means of muriate of barytes, the quantity contained in the sulphates of magnesia and of lime is determined, and by deducting this last portion the proportion of sulphate of magnesia is ascertained. Lime-water precipitates the whole of the magnesia and alumina from the second portion of the water, and the quantity of these earths indicates the proportion of muriate of magnesia and alumina, deducting that portion of magnesia which appeared in the state of sulphate in the first portion of the water. The sulphuric acid is then precipitated by barytic water, the lime by carbonic acid, and the common salt is obtained by evaporating the water to dryness.

Nitrate of potash or nitre, may exist in water with all sulphates and muriates which are not incompatible with each other. After sufficient evaporation, the sulphates are precipitated by acetate of barytes, and the muriates by acetate of silver. The solution being then filtered and evaporated to dryness, and the residue being treated with alcohol, the acetates are dissolved; the amount of nitrate of potash remaining may then be estimated; but if soda be detected in the water, it must be previously saturated with sulphuric acid. If common salt, nitrate of lime, muriate of lime, and muriate of magnesia, be held in solution along with the nitre, the water is to be evaporated to dryness, and alcohol added to dissolve the earthy salts. The dry residue being dissolved in water, the nitre and common salt are separated by acetate of silver. The spirituous solution is then evaporated to dryness, and the residue dissolved in water. The weight of muriate of magnesia is determined by

Of Soils. precipitating with sulphuric acid; 35 parts of lime denote 100 of dry nitrate of lime.

Those who wish to pursue the methods of analysing mineral waters at greater length, may consult with advantage Kirwan's *Essay on Mineral Waters*; Saunders *on Mineral Waters*, in which Dr Marcet's excellent analysis of the Brighton Spa is inserted, and a Memoir in *Edinburgh Transact.* Vol. VIII. by Dr Murray.

Chap. III. Of Mineral Substances.

All the substances which have been the objects of investigation in the former part, enter into the composition of minerals, which have been arranged under four classes, namely, earths and stones, salts, combustibles, and metallic ores.

In the examination of mineral bodies, with the view of discovering their composition, it may be necessary, first, to determine to which of the four classes they belong. If the substance to be examined be without taste, insoluble in water, have a specific gravity below 5, and remain nearly unchanged when placed on hot coals or a red hot iron, it may be inferred that it is to be classed with the earths and stones. If it be suspected to contain a considerable proportion of saline matter, a determinate quantity, reduced to fine powder, may be well shaken in a bottle, with 30 or 40 times its weight of water at the temperature of 120 or 130°; and after having stood for a few hours, the whole may be poured on filtering paper, the weight of which is previously known. When the water has passed through, let the powder be dried on the filtering paper at the temperature of boiling water, and when it is perfectly dry let it be again weighed; and if the encrease of weight be considerable, it may be supposed that the mineral contains saline matter, and ought to be arranged with the class of salts. The characteristic properties of inflammable substances, which constitute the third class, are, that they are either entirely or in large proportion consumed when they are placed on a red hot iron, or being mixed with powdered nitre they produce detonations when they are thrown into a red hot crucible. The quantity of inflammable matter is ascertained by the loss of weight after combustion. But as some of the ores of the metals may afford similar results when treated in the same way, it will be easy to distinguish them before trial by the difference of specific gravity. The mineral bodies belonging to the class of metallic ores are generally distinguished by their greater specific gravity; and all minerals which are more than five times heavier than water, may be considered as belonging to this class. But the detail of the characters of mineral bodies more properly belongs to Mineralogy, which will be treated of under Geology; and the remaining part of this chapter will be devoted to a short account of the method of analysing soils.

Analysis of Soils.

As the opinion formed of the fertility of soils depends on a knowledge of the nature and proportions of the ingredients which enter into their composition, their analysis becomes a subject of no small importance. The investigation of the nature of soils has been pursued by Mr Kirwan and Sir Humphry Davy; and the following is a comprehensive view of the method adopted by the latter in his analysis of soils. Of Soils.

The instruments requisite for the analysis of soils, are neither numerous nor expensive—a balance of tolerable accuracy, with a series of weights, from a quarter of a pound troy to a grain; a wire sieve that will admit a pepper-corn through the openings; an Argand lamp and stand, some glass bottles, Hessian crucibles, porcelain or queen's ware evaporating basins, a Wedgewood pestle and mortar, filters of blotting paper, a bone knife, and an apparatus for collecting and measuring elastic fluids.

The chemical re-agents, which are necessary for separating the constituent parts of the soil, are muriatic acid, (spirit of salt,) sulphuric acid, (oil of vitriol,) pure ammonia, or volatile alkali, dissolved in water, solution of carbonate of ammonia, solution of prussiate of potash, of muriate of ammonia, of neutral carbonate of potash, and of nitrate of ammonia, and soap ley.

When it is necessary to ascertain the general nature of a soil, specimens of it should be collected from different places of the field, and to the depth of two or three inches below the surface; and if the examination is not to be proceeded in immediately, the specimens collected should be preserved in phials, entirely filled with them, and well closed. The most convenient quantity for a perfect analysis is from 200 to 400 grains, and it should be taken up in dry weather, and exposed to the atmosphere till it feel dry to the touch. The specific gravity, which is of some importance to be known, as it affords an indication of the quantity of vegetable matter in a soil, is ascertained by pouring water into a phial till it is half full, and filling up the remainder with the soil to be examined. The difference between the weight of the soil and that of the water, gives the result: thus, if the bottle contains four hundred grains of water, and gain 200 grains when half filled with water and half with soil, the specific gravity of the soil is 2, or twice as heavy as water, and if it gain 165 grains, the specific gravity would be 1825, water being 1000°.

Before proceeding to the analysis, some of the other physical properties of soils should be known, since to a certain extent they indicate their composition, and serve as guides in conducting the experiments. Thus, siliceous soils are generally rough to the touch, and when rubbed upon glass scratch it; clay or aluminous soils, give out a strong earthy smell when breathed upon, and adhere strongly to the tongue; and calcareous soils, which are less adhesive than clay soils, feel soft to the touch.

Soils, even after being exposed for some time to the air, still retain a considerable quantity of moisture, which can only be expelled by strong heat. In proceeding with the analysis, therefore, a given weight of the soil is to be freed as much as possible from water, without producing any change in its composition. This may be accomplished by heating it for ten or twelve minutes over an Argand lamp, in a porcelain basin, and at the temperature of about 300° of Fahrenheit. The proper degree of heat may be ascertained without a thermometer, by keep-

Of Soils.

ing a piece of wood in contact with the bottom of the vessel, and as long as the colour of the wood remains unchanged, the heat is not too great, but when the wood begins to be charred, the process must be stopped. The loss of weight observed in this process must be carefully noted, and if in 400 grains of soil it reaches as high as 50, the soil may be considered very absorbent, and retentive of water, and will generally be found to have a large proportion of clay in its composition. But if the loss of weight be only from 20 to 10, soil of this description is but slightly retentive of water, and a large proportion of siliceous earth may be expected.

As the loose stones, gravel, or large vegetable fibres, which are mixed with the soil, often attract and retain moisture, none of these substances should be separated from it till the quantity of water in the soil is ascertained. After heating the soil, and expelling the moisture, the next part of the process is to separate the loose stones by passing the soil to be examined, after being bruised in a mortar, through a sieve. The weight of the different substances separated, as of the vegetable fibres or wood, and of the gravel and stones, should be separately noted down, and at the same time the nature of the gravel or stone should be ascertained. If they are calcareous they will effervesce with acids; if siliceous, they will be found sufficiently hard to scratch glass; and if they belong to the aluminous class of stones, they do not effervesce with acids, but may be scratched with a knife.

Most soils, beside gravel and stones, contain variable proportions of sand, of different degrees of fineness, and it is necessary to detach them from the parts in a state of more minute division, such as the clay, loam, marl, and vegetable and animal matter. This may be done by agitating the soil in water; the coarse sand is separated after a minute's repose, and the finer in two or three minutes, while the minutely divided vegetable or animal matter remains for a longer time suspended in the water, so that by pouring it off after two or three minutes, the sand will be principally separated from the other substances, which, with the water containing them, must be poured upon a filter, and, after the water has passed through, collected, dried, and weighed; the different quantities of sand must also be weighed, and the amount of weight noted down; and as the water may contain saline matter, any soluble, animal, or vegetable matters that exist in the soil ought likewise to be preserved.

By the process of washing and filtration the soil is separated into two portions, the sand and the minutely divided matter. A nice analysis of the sand is rarely necessary; it is either siliceous sand, or calcareous sand, or a mixture of both; if it consist of the latter, it will dissolve rapidly in muriatic acid, and with effervescence; but if it be partly siliceous matter, the respective quantities may be determined by weighing the residue after the action of the acid. This residue is the siliceous part, and, after being washed and dried, it is to be strongly heated in a crucible; the difference between the weight of the whole indicates the proportion of calcareous sand. The finely divided matter of the soil is usually of a very compound nature. Beside animal and vegetable matter, it sometimes contains all the four primitive earths or soils. The first process in this part of the analysis is to subject the fine matter of the soil to the action of muriatic acid, by pouring the liquid upon the earthy matter in an evaporating basin, in a quantity equal to twice the weight of the earthy matter, but diluted with double its bulk of water. After being frequently stirred, the mixture should be allowed to remain for an hour or an hour and a half before it is examined. During that time the acid takes up the carbonate of lime or of magnesia that exists in the soil, and sometimes a little oxide of iron, but seldom any alumina. The liquid is then to be passed through a filter, the solid matter collected, washed with rain water, dried with a moderate heat, and weighed, and the loss of weight denotes the quantity of solid matter dissolved. The washings must be added to the solution, and, if not sour to the taste, is to be made so by the addition of a fresh portion of acid, when a little solution of prussiate of potash is to be mixed with the whole. If a blue precipitate be produced, it indicates the presence of oxide of iron, and the solution of the prussiate must be added till it ceases to produce any farther effect. Being collected and exposed to heat, the amount of oxide of iron may be ascertained by weighing.

To the liquid thus freed from oxide of iron, a solution of neutralized carbonate of potash is to be added till the effervescence ceases, and till the taste and smell indicate a considerable excess of alkaline salt. The precipitate is carbonate of lime, which, after being collected on the filter, is to be dried with a heat below that of redness. The remaining liquid being boiled for a quarter of an hour, the carbonate of magnesia, if any exist in the soil, is precipitated; and if a minute proportion of alumina should be dissolved by the acid, it will be found in the precipitate with the carbonate of lime, from which it may be separated by boiling for a few minutes with soap ley sufficient to cover the solid matter. In this way the alumina is dissolved, but not the carbonate of lime.

If the finely divided soil effervesce strongly with acids, the quantity of carbonate of lime may be ascertained by a simple and sufficiently accurate method, which is, by observing the quantity of carbonic acid given out by any soil during the solution of its calcareous matter in an acid, either in weight or measure, for carbonate of lime in all its states contains about 45 per cent of carbonic acid. When this process by diminution of weight is employed, two parts of the acid and one part of the matter of the soil are to be weighed in separate bottles, and slowly mixed till the effervescence ceases; the difference between their weight before and after the experiment, indicates the quantity of carbonic acid lost; for every 4½ grains of which, 10 grains of carbonate of lime is to be allowed, and for every ounce measure of carbonic acid, about two grains of carbonate of lime is to be estimated.

The next step in the process, after the action of the muriatic acid on the soil, is to determine the quantity of finely divided insoluble animal and vegetable matter. This is done by heating it strongly in a crucible over a common fire, and stirring it frequently with a metallic wire to expose new surfaces to the air, till the mass ceases to be black. The diminution of weight indicates the quantity of matter that is destructible by fire. It is impossible to ascertain whether this substance is wholly animal or vegetable matter, or a mixture of the two; but the smell of burnt feathers during the incineration, denotes animal matter; while a copious blue flame at the time of ignition is an indication of a large proportion of vegetable matter.

Minute particles of earthy matter, which usually contain alumina and silica, combine with oxide of iron, and remain after the decomposition of the vegetable and animal matter. For the separation of these substances, the solid matter should be boiled two or three hours with sulphuric acid, diluted with four times its weight of water; and for every 100 grains, two drams, or 120 grains of acid, are to be allowed. Any substance that remains after the action of the acid may be considered as siliceous, and being separated, washed, and dried, the amount may be ascertained by weighing it.

Sulphuric acid dissolves the alumina and oxide of iron; and carbonate of ammonia, added to excess, throws down the alumina, and leaves the oxide of iron in solution, which latter may be separated by boiling.

It rarely happens that magnesia and lime escape the action of muriatic acid; but should this be the case, they will be found in combination with sulphuric acid. The method of analysis by sulphuric acid is sufficiently precise for all usual experiments; but if greater accuracy be wished for, dry carbonate of potash is to be employed; and the residue of the incineration being heated red for half an hour, with four times its weight of this substance, in a crucible of silver, or of well-baked porcelain, is to be dissolved in muriatic acid; and the solution being evaporated till it is nearly solid, the addition of distilled water dissolves the oxide of iron, and all the earths, except silica, in the state of muriates. The silica, after the usual process of lixiviation, is to be heated red, and the other substances are separated in the same manner as from the muriatic and sulphuric solutions.

The saline matter, or soluble, vegetable, or animal matter, that may be suspected in the soil, will be found in the water of lixiviation which is employed for separating the sand. This water being evaporated to dryness in a proper vessel, at a temperature below its boiling point, if the solid matter obtained be of a brown colour and inflammable, it may be considered as partly vegetable extract. If the smell, when it is heated, be strong and fetid, it contains animal, mucilaginous, or gelatinous matter; but if it be white and transparent, it may be considered chiefly as saline matter. Nitrate of potash, or nitrate of lime, is indicated by its detonation with red-hot coals; sulphate of magnesia is known by its bitter taste; and sulphate of potash precipitates solution of muriate of barytes, but has no effect on carbonate of ammonia.

If the soil be suspected to contain sulphate or phosphate of lime, a given weight of it, as for instance 400 grains, being heated with one-third of powdered charcoal in a crucible, and kept at a red heat for half an hour, is to be boiled for a quarter of an hour in half a pint of water, and the liquid, after passing through the filter, is to be exposed in an open vessel for some days to the atmosphere. If any soluble quantity of sulphate of lime existed in the soil, a white precipitate is gradually formed in the fluid, and the proportion is indicated by the weight. After this process, phosphate of lime, if any exist, may be separated by digesting muriatic acid upon the soil, in quantity more than sufficient to saturate the soluble earths. The solution being evaporated, and water being poured on the solid matter, the muriates of the earths are dissolved, and the phosphate of lime remains untouched.

Having completed the examination of a soil, the products should be arranged in the order of the experiments by which they were obtained, and the amount of these products being added together, if it be nearly equal to the original quantity of the soil, the analysis may be considered as tolerably accurate. Here it is necessary to observe, that if phosphate or sulphate of lime is discovered by the last process described, a correction must be made for the general process, by subtracting a sum equal to their weight from the quantity of carbonate of lime obtained by precipitation from muriatic acid.

Chapter IV. Of Vegetables.

Natural bodies have been divided into organized and inorganized; to the latter class of which belong all the substances which have hitherto been the subjects of examination; and under the former are included vegetables and animals. In the mode of formation, or in the growth and increase of the individuals of these two classes of bodies, a striking diversity appears, from which certain marks of distinction may be drawn. In the class of inorganized substances, the growth or increase takes place by the mere aggregation of the particles of matter already prepared. But the substances which enter into the composition of vegetables or animals, are received into tubes or vessels, conveyed to all parts of the vegetable or animal, undergo peculiar changes, and assume new forms, none of which could be previously detected by any chemical or mechanical process in the simple elements. The laws which regulate animal and vegetable operations seem to be totally different from the established laws of chemical action; and hence, from observing this diversity of action, the existence and influence of a different principle, which is called the *vital principle*, or the *principle of life*, have been inferred in animals and vegetables. By the influence of this principle, the varied and complicated phenomena of animals and vegetables are exhibited.

Organized substances are susceptible of a natural division into vegetables and animals; and the bodies included under each of these divisions, although they possess some common characters, yet they are sufficiently characterized by their form, structure, power of motion, component parts, and peculiarity of habits.

A vegetable consists of a root, stem, leaves, flowers, fruits, and seeds; and when all these different parts are fully developed, and obvious to examination, the vegetable is said to be *perfect;* when any of them

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The root, concealed in the earth, conveys nourishment to the whole plant, and the stem supports all its other parts; when it is large and solid, it is called the trunk, and it is divided into the wood and bark. The bark, composed of three layers, the epidermis, parenchyma, and cortical layers, forms the external covering to the whole plant. The wood consists of concentric layers, which increase with the age of the plant, and is divided into the alburnum which is softer and whiter, and the perfect wood which is harder and of a darker colour. The pith, which occupies the middle of the stem, is a soft spongy substance, composed of cells, and disappears in old wood; the leaves consist of two layers of fibres arranged in the form of net work, and proceeding from the stem and foot-stalks by which they are attached to the branches; and the flowers, which are composed, when they are perfect, of a calyx, corolla, stamens, pistils, seed-vessels, and some other parts, are destined to the formation and ripening of the seeds.

The vessels of plants are of different kinds; the lymphatic vessels serve for the circulation of the sap, and are chiefly placed in the woody part of the plant. The peculiar vessels contain thick or coloured fluids, are smaller in number than the sap vessels, and are situated immediately under the bark. Some of these proper vessels are situated between the epidermis and the bark; some of them form oval rings in the interior part of the bark; and some are placed in the alburnum, and sometimes in the perfect wood. The tracheæ or spiral vessels constitute another set of vessels in plants, are readily detected in succulent vegetables, and may be drawn out to a considerable length without breaking. These spiral vessels are numerous in all plants, especially under the bark, where they form a kind of ring, and are disposed in distinct bundles in trees, shrubs, and in the stems of herbaceous plants.

Sect. I. *Functions of Plants.*

In tracing the progress of vegetation from the time that a seed is put into the ground till it spring up and produce leaves, flowers, fruit, and perfect seeds, physiologists have marked the changes and different processes which take place during the growth and perfection of the vegetable, and have described the different functions which the different parts seem destined to perform.

1. *Germination.*

When the perfect seeds of a vegetable are placed in favourable circumstances, plants exactly similar to those from which they originated, are produced; and the requisite circumstances are heat, air, and moisture. No vegetation takes place till the temperature of the air is above the freezing point, and it remains equally inactive, whatever be the temperature, if the air be entirely excluded. Moisture is equally essential to germination; but the application of moisture must be regulated, for when it is either excessive or deficient, the process of vegetation goes on imperfectly, or is altogether interrupted; and hence the advantage of preparing soils to retain the proper degree of moisture.

Vegetables. A seed is composed of three principal parts, which are called the cotyledons, or lobes, the plumula, and the radicle. When a seed is placed in favourable circumstances for germination, the enlargement of size by the absorption of moisture is the first change observed, the radicle or little root is formed, and stretches downwards into the earth, and the plumula shoots upwards, and expands into leaves and branches. It is the peculiar function of the root to convey nourishment from the earth for the future growth of the plant,—but in what way is the root itself first formed?

As it is observed that no seed germinates without air, the first change which takes place within the seed, is the combination of the oxygen of the atmosphere with the carbone, and the formation of carbonic acid, which is emitted in the state of elastic fluid. In this way, a portion of carbone being extracted from the farinaceous substance of the seed, the remainder is converted into a saccharine matter, which is destined to the nourishment of the young plant till its parts are more fully developed, and its structure so far completed as to derive the necessary nourishment from the earth. The absorption of oxygen, therefore, the evolution of carbonic acid gas, and the conversion of the farinaceous matter of the seed into saccharine matter, are the first changes in the process of germination.

2. *Food of Plants.*

After the complete evolution of the different parts of a plant, the same agents must continue to operate, and are absolutely necessary to its future health and vigour. Plants, it is well known, cease to vegetate when they are entirely deprived of moisture,—and hence some of the earlier physiologists adopted the opinion, that water alone constituted the chief, or the only food of plants; but it appears, from experiments made on those vegetable productions which are raised in pure water alone, that they are greatly deficient in the quantity of carbonaceous matter which properly belongs to such plants when they grow in favourable circumstances.

But water is necessary as a solvent for those substances which are considered as the proper food of vegetables; and as water is impregnated with certain saline and earthy, but especially with carbonaceous matter, it is found to be most proper for promoting the growth, and increase of plants. Hence, it is requisite that the waste of the soil be frequently repaired with the additions of manure, which usually consists of vegetable or animal matters, or of mixtures of both, and these additions may be considered as necessary supplies of food or nourishment.

Whatever be the food of plants, it is taken up by the roots in a state of minute division, or in solution in water, and is conveyed by the vessels to every part of the plant. The fluid which is found in plants, is called the sap; it is most abundant in the spring, at which time, if the plant be wounded, it flows out copiously. This bleeding, as it is called, is remarkable in some trees, such as the birch, and a species of maple, from the sap of which, subjected to certain processes, wine or sugar is prepared. It can scarcely be doubted that the fluids taken up by vegetables undergo peculiar changes as soon as they enter the plant. The greater proportion of the sap of the elm, which was chemically examined, is composed of acetate of potash, with some vegetable matter, and a small portion of carbonate of lime. In a more advanced period of the season, the quantity of vegetable matter had greatly increased, and corresponded with the diminution of the acetate of potash and carbonate of lime. The sap of other plants subjected to a similar examination, was found to contain acetate of potash and lime, mucilage, sugar, and extract with water, as in the horn-beam; and water, the acetates of lime, alumina, and potash, with sugar, and vegetable extract, as in the birch. In the sap of other plants, some other vegetable productions were traced, as in that of the beech, in which a portion of gallic acid and tan was detected, and was observed to increase in the later periods of the season. It appears, from these experiments, that the fluids taken up by vegetables are immediately changed by certain processes within the plant, and give origin to new substances, no trace of which could be observed in the liquid before it entered the plant; and these changes appear to be considerably greater in the advanced periods of vegetation.

3. *Functions of Leaves.*

The sap is carried through every part of the vegetable, and the change which it undergoes is more considerable according to the length of time after it has been absorbed; and as the greatest changes which take place on the sap of plants are effected in the leaves, they are properly reckoned among the essential organs of vegetables, for in them the sap is totally changed and converted into the peculiar juice of the plant.

The leaves of plants transpire during the day a great deal of moisture, and the proportion is greatest during sun-shine and warm weather; it is interrupted during the night, and entirely checked by cold. This transpiration of moisture takes place chiefly on the upper surfaces of the leaves, and seems to be performed by a particular set of organs. During the day, and especially during bright sun-shine, oxygen gas is given out by the leaves of plants, and the quantity, as appears from experiment, seems to depend on the quantity of carbonic acid which is absorbed; for if water, with which plants are supplied, be deprived by boiling of the whole of its air, no oxygen gas is evolved; and water which is impregnated with the largest proportion of carbonic acid gas, when it is taken up by plants, enables them to give out the largest proportion of oxygen gas.

This process goes on only during the day, and as it is most vigorous during bright sun-shine, it is an obvious inference, that light contributes something to these changes, for when it is entirely excluded plants do not acquire a green colour, and in such cases the proportion of carbonaceous matter is diminished. From this it appears that the carbonic acid gas absorbed by plants is decomposed, its base, carbone, being deposited, and the oxygen being given out; and as light is a necessary agent in promoting this decomposition, an interruption of the process may be expected when light is excluded. This decomposition takes place in the parenchymatous substance of the leaf, and the quantity of oxygen gas evolved seems to correspond in some degree to the thickness of this substance.

It appears then to be one part of the functions of the leaves of plants to exhale a considerable proportion of the moisture taken in by the roots, to absorb carbonic acid gas, to decompose this gas, and, while its carbone is retained in the plant, to emit the oxygen. These processes go on during the day, but during the night the leaves perform a very different function. Carbonic acid gas is then given out, and moisture and oxygen gas are absorbed, and the absorption of moisture seems to be performed, at least in many plants, by the under surface of the leaves. By these different processes, which are carried on in the leaves of plants by the abstraction of some of its principles, and by entering into minute combinations with others, the sap undergoes very great changes, for in them it is converted into the peculiar juice of the plant, from which are derived by other processes the different substances which are deposited in the different parts of plants.

The sap of plants flows from the roots towards the branches and leaves, undergoes peculiar changes in the leaves in consequence of part being exhaled and part being absorbed, and is converted into the peculiar juice from which the various substances so different in their nature and character derive their origin. The course of the peculiar juice is the reverse of the sap; it flows from the leaves towards the roots, and if a wound be made in the bark, the greatest quantity exudes from that side of the wound which is next to the leaves. The peculiar juice is distinguished by its greater consistence, and is readily recognised by its colour. In many plants it is milky; in some it is of a green colour, and in others it is red; and it seems to contain a greater proportion of carbone, hydrogen, and oxygen, the elements which constitute the different parts of plants, than what is found in the sap.

Sect. II. *Decomposition of Vegetables.*

When a plant ceases to vegetate, it immediately undergoes, at least in certain circumstances, a new set of changes. The whole plant is broken down, the elements of which it is composed form new combinations, and new substances, which either do not previously exist in the plant, or could not be detected, make their appearance. This decomposition is partly owing to the affinities between the component parts of the vegetable, and partly to the affinities between some of the elementary principles of the plant, and the heat, air, and moisture, without which no decomposition is effected. A plant in its living state possesses the power of resisting to a certain extent the action of external agents, as well as the chemical action between the elements of which it is composed.

Heat, air, and moisture, are necessary for the decomposition of vegetables; elastic fluids are generally given out, and new and unexpected compounds are formed; some plants, and some parts of the same plant, have a greater tendency to this decomposition than others, because they either possess a larger proportion of the substances which serve to excite and promote the decomposition, or a larger proportion of the ingredients of which the new products are composed.

The spontaneous decomposition of vegetables is almost always accompanied with an intestine motion. This process is distinguished by the name of fermentation; and as the changes are very different, both with regard to the elastic fluids which are evolved or absorbed, and the nature of the products which are obtained after the process is finished, fermentations have been usually divided into three kinds, the vinous, the acetous, and the putrid. The product of the first is wine or beer, of the second vinegar, and during the last the vegetable matters are still farther decomposed, and run into the state of putridity. But while the different kinds of fermentation now enumerated might be considered as different stages of the same process, which if not checked at certain periods, run on from the first to the last, some think that they do not include all the changes having the characters of this process to which vegetables are subject. To them it has been proposed to add the saccharine fermentation, or that change which is induced on farinaceous seeds by heat and moisture, as in germination, or the process of malting; the colouring fermentation, or that process by which the colouring matter of vegetables, as indigo, is separated; and the panary fermentation, or the process of making bread.

1. *Vinous fermentation.*

The vinous fermentation, which is otherwise denominated the spirituous, is so called because the first product is wine, and wine when distilled yields spirits or alcohol. All vegetable substances are not susceptible of the vinous fermentation, and certain conditions are necessary for its commencement and progress.

Saccharine matter is a necessary ingredient in those substances which are susceptible of the vinous fermentation; and hence it is that the sweet juices of fruits are usually employed in this process, and particularly the juice of the grape for the production of wine. But sugar must be dissolved in water, for in a state of purity it is not susceptible of any change. Water, therefore, is one of the essential conditions of the vinous fermentation, and it seems requisite that it should neither be excessive nor deficient in quantity, for when it is deficient the fermentation is interrupted, and when it is too abundant it proceeds too rapidly, and is apt to run into the acetous or acid fermentation. The addition of other substances beside sugar and water is also necessary. The *must*, or liquid expressed from grapes, contains, besides sugar, a portion of jelly, some glutinous matter and tartar, all which contribute their share to the fermenting process. A certain temperature is also a requisite condition for this process. The vinous fermentation scarcely commences if the temperature be less than 60°, but it proceeds rapidly when the heat rises to 70°. A large mass is favourable to vinous fermentation; for when the quantity of saccharine matter is small it scarcely undergoes this change, and is apt to run speedily to the acid fermentation.

In favourable circumstances fermentation commences sooner or latter, according to the temperature and the quantity of liquid employed. Sometimes it begins in a few hours, and sometimes no perceptible change is observed for a few days. The first change is an intestine motion of the liquid, it becomes thick and muddy; the temperature increases, carbonic acid gas is disengaged, the whole mass of the liquid is enlarged in bulk, and the surface is covered with frothy matter. The disengagement of carbonic acid gas, which is very considerable during the process, begins at the commencement of the fermentation, and continues till its termination. At the end of a few days, or a longer or shorter time, which varies according to the temperature and other circumstances, the fermentation ceases, the liquid becomes transparent, the matters which cause the muddiness having subsided, it becomes sharp and hot instead of being sweet to the taste, and more liquid and lighter instead of being viscid and glutinous. The liquid is now converted into wine.

The new products shew clearly that some essential changes have taken place during this process. Among these changes the diminution of the sugar, during the progress of the fermentation, and its entire decomposition at the end of the process, are not the least remarkable. The liquid is now more fluid, is specifically lighter, and has acquired a vinous taste. These new properties are attributed to the alcohol, or spirit, which exists in all wine. The sugar, which appears to be the only substance decomposed in the process, is divided into two portions, one of which is carried off in the form of carbonic acid gas, and the other, containing a great proportion of hydrogen, remains in the liquid in the form of alcohol. Part of the alcohol is also carried off, and that portion which remains in the liquid is combined with the acids of the wine, and the colouring matter, from which it must be separated by distillation.

Wines exhibit great variety in colour, flavour, and strength; some of these differences depend on the kind of grapes, and the nature of the soil on which they are produced, and some are owing to the method of conducting the manufacture. But the component parts of wine are generally some acid matter, alcohol, extractive matter, oil, and colouring matter. The predominant acid in wines is malic acid; citric acid has been detected in some, and certain wines contain a large proportion of carbonic acid. The strength of wines is owing to alcohol, and when they are distilled the alcohol passes over, and the spirit which is thus obtained is called brandy. The extractive matter of wines is observed to diminish in proportion to their age, as it separates gradually from the liquid and collects at the bottom. The peculiar flavour and odour of wines are ascribed to a volatile oil, which is in such small quantity that the means employed for its separation have not hitherto succeeded. The colour of wines is derived from the husk of the grape.

The juices of other fruits as well as those of the grape, furnish materials for fermentation, as those of

Vegetables.

the currant and gooseberry, of which wine is made, that of apples which affords cyder, and that of pears which yields perry. Cyder and perry are distinguished from wines properly so called, by a larger proportion of mucilaginous matter. A fermenting liquid is also obtained from the juice of the sugar cane; and this liquid being distilled affords rum.

Beer or malt liquors are prepared from the fermented infusions of farinaceous seeds; for this purpose different kinds of corn are employed, but in Britain barley is the most common grain in the preparation of such liquors. After being steeped in water, it is thrown together in a heap, and in consequence of the moisture which it has imbibed the process of germination commences; oxygen gas is absorbed, carbonic acid gas is given out, heat is evolved, and the radicle is protruded. The process is then checked by slow drying, for which purpose it is spread out on a floor; it is afterwards exposed to heat, fully dried, and then reduced to a coarse powder. The malt thus prepared is infused with water, at the temperature of 160° or 170°; and after remaining for some hours, the liquid is drawn off, and more water is added, till the whole soluble part of the malt is extracted. The *wort*, as the infusion is now called, has a sweet taste from the saccharine matter which it contains, a peculiar odour, and a brownish colour. Being boiled with some bitter substances, as hops, it is allowed to ferment, and the process of fermentation proceeds much in the same way as in the fermentation of wine. The product is beer or ale.

The constituent parts of *wort* are saccharine matter, to which the sweet taste is owing, and which is in largest proportion; a portion of starch, some glutinous matter, and mucilage. The temperature which seems most suitable for the fermentation of wort is about 60°; but to promote this process the addition of some substance is found necessary; and when yeast, which is the substance usually employed, is added, the quantity of the fermented liquor is increased. This fermented liquid, as well as wine, affords alcohol by distillation.

Fermented liquors always contain a portion of alcohol, and to this liquid their strength is owing. It has been a subject of speculation among chemists, whether the alcohol obtained from fermented liquids be ready formed, or whether it is to be considered as a product of the process of distillation. The experiments of Mr Brande are decidedly in favour of the former opinion, and shew that it is merely separated during this process. The following table exhibits the results of his experiments on different wines. The quantity of alcohol by measure, and of the specific gravity 0.825 obtained from 100 parts of the wine, is noted.

Lissa	26.00	Lisbon	18.94
Ditto	24.00	Malaga	17.26
Port, 7 specimens, from 19.00 to	25.83	Do. kept since 1666	18.00
		Red Madeira	18.40
Madeira, 4 specimens, from 19.34 to	24.42	Malmsey Madeira	16.40
		Marsala	17.26
		Ditto	25.50
Sherry, 18.25 to	19.83	Ditto	25.87
Claret 12.91 to	16.32	Ditto	26.30
Burgundy	11.95	Cape Madeira	18.11
Ditto	14.53	Constantia	19.79
White Hermitage	17.43	Tent	13.30
Red Hermitage	12.32	Tokay	9.88
Hock	8.88	Raisin wine	25.77
Ditto	14.37	Currant wine	20.55
Vin de Grave	12.80	Gooseberry wine	11.84
Frontignac	12.79	Elder wine	9.87
Cote Roti	12.32	Cyder	9.87
Red Champagne	11.30	Perry	9.87
White Champagne	12.80		

2. *Acetous Fermentation.*

When wine, or beer, which is the product of the vinous fermentation, is exposed to a temperature between 70° and 90°, it becomes gradually turbid the heat is increased; a new intestine motion commences, and flaky substances are seen floating through it in all directions. At last the intestine motions cease; the substances which produce the turbidity fall to the bottom, and the liquid becomes transparent, and has assumed totally different properties. It is now vinegar or acetic acid.

The requisite conditions for the acetous fermentation, are a considerable elevation of temperature and exposure to the air of the atmosphere. A certain proportion of extractive matter is also necessary. Beer or weak wines are more readily converted into vinegar than when those liquids are of greater strength. But when the acetous fermentation has once commenced on the stronger liquids, the product is a stronger and better vinegar. In examining the products of the acetous fermentation, it is found that the whole of the malic acid and of the alcohol which previously existed in the wine have disappeared, so that by their decomposition they have contributed to the formation of the vinegar. A portion of the extractive or glutinous matter is also decomposed; some of it is deposited in the form of flakes, and some of it remains in solution with the vinegar. Sugar is also an essential ingredient in the liquid, which is susceptible of the acetous fermentation; and it appears that the quantity of vinegar obtained during the process, is in proportion to the quantity of sugar, provided the sugar does not exceed an eighth part of the liquid; for otherwise the whole is not decomposed during the fermentation. A good vinegar may be made from seven parts of water and one of sugar, with a portion of yeast to promote the fermentation.

3. *Putrefactive Fermentation.*

The last stage in the decomposition of vegetable matters is the putrefactive process. The effects of this process present considerable diversity in different vegetables. In some the parts are completely separated and resolved into their primary elements, by the escape of those substances which held them together, and in others by a set of attractions and combinations new compounds make their appearance.

Certain conditions are also necessary for promoting the putrefactive process; the first requisite is moisture, for when vegetables are kept perfectly dry, no change is induced; the access of air is also necessary, and a moderate degree of heat, when the temperature is too high. The moisture is carried off before the changes commence; but if the moisture be not permitted to escape, a high temperature is favourable to putrefaction.

When vegetables are placed in those circumstances which are favourable to this process, the first change observed is in the colour and consistence; the texture is destroyed, the fibres separate, and the soft and liquid parts are enlarged in bulk; elastic fluids are disengaged, and the heat is often very considerably increased. The elastic fluids given out are composed of a mixture of carbonated hydrogen, carbonic acid, and azotic gases. This process is completed in a longer or shorter time, according to the nature and consistence of the vegetable matters.

Among the numerous attractions of the different materials during the putrid fermentation of vegetables, part of the hydrogen combines with the oxygen, and forms water; part escapes in the state of gas combined with carbone, and another portion of hydrogen unites with the azote of certain plants, such as cruciform plants, and forms ammonia. Another portion of the hydrogen communicates odour and colour to the remaining mass. The carbone combines partly with the hydrogen given out, partly with the oxygen forming carbonic acid, and part remains behind; and the oxygen is divided between the hydrogen and carbone, forming water and carbonic acid.

Sect. III. *Component parts of Vegetables.*

The nature and properties of those substances which enter into the composition of vegetables come next under examination. Some of the products of the vegetable process are obtained from plants during their growth, such, for instance, are gummy and resinous matters, which many plants throw off by spontaneous exudation; and such too are saccharine matters, which are prepared from the sap as it is extracted by wounding the bark and wood, with little seeming injury to the health and growth of the plant. But in general the substances formed during the process of vegetation, or which are to be considered as the constituent parts of vegetables, can only be obtained by the destruction of the vegetable itself. The substances which are obtained from vegetables amount to a considerable number, and are distinctly characterized either by their sensible properties, or by their effects on chemical re-agents. A brief detail of the more important of these substances is now to be given.

1. *Gum.*

Gum is the spontaneous exudation of many trees during the process of vegetation. It is in the form of a transparent, viscid, insipid fluid. The purer kind of gum is obtained from different species of *mimosa*, and particularly from the *mimosa nilotica*, a plant common in many parts of Africa, and, perhaps from being first brought from Arabia, is now familiarly known by the name of *gum arabic*. When the watery part evaporates it becomes hard, brittle, and transparent; is of a yellowish colour, but when pure is entirely colourless, and it has neither taste nor smell.

Being heated, gum softens and swells, gives out air-bubbles, blackens, and is reduced to charcoal. It is very soluble in water. The solution, which is thick and adhesive, and well known as a paste under the name of mucilage, is little disposed to decomposition, and by evaporation the whole of the gum may be obtained unchanged. It is soluble in the vegetable acids without change, but is decomposed by the stronger acids. By means of sulphuric acid it is converted into water, acetic acid, and charcoal. Muriatic acid, with the aid of heat, has nearly the same effect; and oxymuriatic acid, or chlorine, converts it into citric acid. By the action of nitric acid, with a slight heat, on gum, nitrous gas is given out; and when the solution cools, saclactic acid is deposited, and malic and oxalic acids are also produced. Gum is insoluble in alcohol and ether.

By distillation gum yields acetic acid, carburetted hydrogen, and carbonic acid gases, charcoal, lime, and a small portion of phosphate of lime; and thus the constituent parts of gum are chiefly oxygen, hydrogen, carbone, and lime.

Beside *gum arabic*, different species of gum are obtained from other plants which resemble it nearly in their general properties, as *gum senegal*, which is in larger masses, and of a darker colour; *gum tragacanth*, the produce of *astragalus tragacantha*, which is in the form of vermicular masses, is less transparent, less soluble in water, and more adhesive; and the gum from the plum and cherry tree, which is of a brownish colour, softer, and more soluble in water.

Gum in the state of mucilage exists in many plants, and particularly in the roots, leaves, and seeds. It is very abundant in bulbous roots, as those of the common hyacinth; in the leaves of althea and mallow; in most of the fuci; in many of the lichens, and in lint-seed, and the seeds of the quince. It is found in greatest proportion in young plants. But although this mucilage is considered by some chemists as a distinct vegetable production, and is described under the name of *mucus*, yet its characters are scarcely marked with sufficient precision to entitle it to a separate place.

2. *Sugar.*

Sugar may be extracted from every part of plants, as from the roots of the beet and carrot, the stems of the birch, the maple, some of the palms, and especially the sugar cane; from the leaves, as those of the ash, and from the flowers, fruits, and seeds. But the sugar of commerce, which may be now considered as a necessary of life, is prepared entirely from the juice of the sugar cane; of the culture of which, and the method of extracting the sugar, a short description will be found under Botany.

When the raw sugar, as it is imported into this country, is purified, it is brought to the state of single or double-refined sugar, when it is of a white colour, has no smell, and is well known for its sweet taste. It is hard and brittle, and is easily reduced to powder; phosphoresces in the dark; and the solution in water being concentrated, affords crystals in the form of six-sided prisms, terminated by two-sided summits.

Sugar exposed to heat melts, swells up, becomes of a dark black or brown colour, gives out a peculiar odour called *caromel* by the manufacturers; and when raised to a red heat, with an explosive noise bursts into flames It is very soluble in water, which, even at a temperature below 50°, dissolves its own weight. Water saturated with sugar is called *syrup*.

Sugar is soluble in many of the acids, is decomposed by sulphuric acid, with heat the acid itself is decomposed, and converted into sulphurous acid, and a copious mass of charcoal is deposited. Nitric acid is also decomposed, nitrous gas is given out, and the sugar is converted into oxalic and malic acids. Sugar absorbs muriatic acid gas, and assumes a brown colour with a strong smell. Oxymuriatic acid, or chlorine, instantly dissolves sugar, which is converted into malic acid, and the chlorine is changed to muriatic acid. One part of sugar is soluble in four parts of boiling alcohol, and it unites with the oils, and renders them miscible with water.

The fixed alkalies unite with sugar, and deprive it of its sweet taste; but if sulphuric acid be added, and the sulphate thus formed be precipitated by means of alcohol, the taste is restored; some of the earths, as lime, strontites, and barytes, form similar compounds with sugar, and thus have their solubility encreased; and by the action of the sulphurets, hydrosulphurets, and phosphurets of the alkalies, and some of the earths, sugar is decomposed and converted into a substance which has a near resemblance to *gum-arabic*.

When sugar is distilled in a retort, water, nearly pure, first comes over; next acetic acid, with a little oil, and a bulky mass of charcoal remains behind. The constituent parts of sugar are therefore oxygen, carbone, and hydrogen, the two former of which are in largest proportion.

In North America sugar is prepared from the juice of the maple tree. The tree is wounded in the spring during the ascent of the sap, and a single tree, it is said, yields from 20 to 30 gallons, from which five or six pounds of sugar are prepared. Attempts have been made on the Continent to extract sugar, even in the large way, from the root of the beet; but it appears that this kind of sugar is contaminated with a peculiar matter, which communicates a bitter nauseous taste; and it is not understood that the manufacture succeeded. Wheat, barley, beans, pease, and other leguminous seeds, especially in the young state, furnish a considerable proportion of sugar.

3. *Jelly.*

The expressed juice of different fruits, as of the red and white currant, when allowed to remain at rest, coagulates into a soft tremulous substance, called jelly. It is purified by pouring off the watery part which still adheres to it, and washing the coagulated part with a little cold water.

Jelly is sometimes quite colourless, but is often tinged with the colouring matter of the fruit; the taste is agreeable and slightly acid; it dissolves readily in hot water; coagulates on cooling; and is nearly insoluble in cold water. Boiling deprives it of the property of coagulating, and then it approaches to the nature of mucilage. By coagulating the juices of those fruits which afford jelly, passing the liquid parts through a filter, and after washing the coagulum with cold water allowing the mass to dry, it becomes less in bulk, is transparent and brittle, and acquires many of the properties of gum; and hence it is supposed that jelly is not different from gum, excepting in being combined with a vegetable acid.

Nitric acid converts jelly into oxalic acid: it combines readily with the alkalies, and when distilled it affords acetic acid mixed with oil, but no perceptible quantity of ammonia.

4. *Acids.*

The acids which are found in vegetables, formerly called their *essential salts*, were supposed to consist of tartar or vinegar; but many different acids have been detected in plants by the labours of modern chemists.

Some vegetables contain only one acid, as the orange and lemon, in which citric acid is formed; in other plants, as in gooseberries and currants, two acids, malic and citric, are mixed together; and the tartaric, citric, and malic acids are united in the pulp of the tamarind.

Acetic acid has been detected in the sap of some trees; it has been found in the *sambucus nigra* or elder, and in *galium verum* or yellow lady's bed straw, which latter plant is employed for the purpose of coagulating milk in some parts of Scotland; oxalic acid, in combination with potash, exists in the leaves of *oxalis acetosella* or wood-sorrel, and in some species of *rumex;* and oxalate of lime has been extracted from the root of rhubarb. The pulp of the tamarind, the juice of grapes or mulberries, of sheep-sorrel, rhubarb, and of *agave americana*, and the roots of couch grass and *dandelion*, contain tartaric acid combined with potash, and in the form of super-tartrate. The juice of oranges and lemons, the cranberry and the red whortle-berry, the bird-cherry and the fruit of the wild rose, furnish citric acid. In the apple, the barberry, plum, rowan, or fruit of the mountain ash, malic acid is unmixed with other acids; and malic and citric acids are nearly in equal proportions in the gooseberry, cherry, strawberry, and currants. United with lime, forming a malate of lime, it exists in *sempervivum tectorum* or houseleek, and in *sedum album*, *acre*, and *telephium*, three species of stone-crop.

Many plants yield gallic acid, and it exists chiefly in the bark. The following are the relative proportions of the quantity of acid in different plants, as they have been ascertained by Mr Biggin.

Elm	7	Sallow	8
Oak cut in winter	8	Mountain-ash	8
Horse chesnut	6	Poplar	8
Beech	7	Hazel	9
Willow boughs	8	Ash	10
Elder	4	Spanish chesnut	10
Plum-tree	8	Smooth oak	10
Willow trunk	9	Oak cut in spring	10
Sycamore	6	Huntingdon or Leicester willow	10
Birch	4		
Cherry-tree	8	Sumac	14

Benzoic acid is obtained from benzoin, balsam of Tolu, liquid storax, and vanilla; and it is probable that the fragrance of sweet-scented grass, *anthoxanthum odoratum*, which communicates the fragrant smell to hay, and woodruff, *asperula odorata*, is derived from the same acid.

Prussic acid has been detected in the leaves of *laurocerasus* and peach blossoms, as well as in bitter almonds, in the kernels of apricots, peaches, plums, and cherries. It is obtained by distilling water off these kernels with a moderate heat; and if lime be added to the concentrated infusion of bitter almonds, a prussiate of lime is formed. Different plants yield phosphoric acid, but it is generally in combination with lime. This phosphate of lime exists in the leaves of many trees, in monkshood, *aconitum napellus*, and in all kinds of grain.

5. *Starch.*

By washing wheat-flour formed into a paste with water, with repeated quantities of water, till it come off pure and colourless, a ductile and tenacious mass called *gluten* remains; and the water, after it is some time at rest, deposits a white powder called starch.

Starch is of a fine white colour, and is usually in the form of concrete columnar masses; it has no perceptible smell, scarcely any taste, and is not altered by exposure to the air. It melts when thrown on a hot iron, swells up, becomes black, and burns with a bright flame. In the remaining charcoal a small portion of potash is detected. It gives out by distillation water mixed with acetic acid, and contaminated with oil, carbonic acid and carburetted hydrogen gases. Starch is not soluble in cold water; but with boiling water forms a thick paste, which, on cooling, becomes semi-transparent and gelatinous; is brittle when dry, and has some resemblance to gum. When this paste is exposed to moist air, it is decomposed, and assumes an acid taste.

Starch is slowly dissolved in sulphuric acid; sulphurous acid is given out, and a copious mass of charcoal is formed. The solution of starch in muriatic acid resembles mucilage of gum-arabic; and when it is left at rest, it separates into a thick oily liquid above, and a transparent straw-coloured fluid below. Starch is also soluble in nitric acid; nitrous gas is given out; the solution becomes green, and with the application of heat the starch is converted into oxalic and malic acids; but a portion is undissolved; and when it is separated by filtration and washed with water, it acquires the appearance of tallow, is soluble in alcohol, and yields by distillation acetic acid, and an oily matter resembling tallow in smell and consistence.

Starch is insoluble in alcohol and ether; but it combines with the alkalies, and the compound becomes soluble in alcohol.

Many vegetable substances, but chiefly the roots and seeds, yield starch in considerable abundance. The potato affords a large proportion; the roots of different species of orchis furnish saloup, which consists mostly of starch; the cassada bread of the West Indies, which is prepared from the roots of *Jatropha manihot*, owes its nutritious quality to the great proportion of starch; sago also, a very nutritious substance, which is extracted from the pith of different species of palm, abounds with starch; and some species of the tribe of lichen afford wholesome nourishment to animals, and even bread to man in northern regions, from the abundance of starch which they contain.

6. *Albumen.*

Albumen, which is closely allied to animal matters, has been detected in the juice of the papaw tree, a production of tropical climates. Brought from the West Indies in the liquid state, and preserved in rum, it was of a reddish brown colour and semi-transparent, with the smell and taste of boiled beef, and in the form of extract it was of a yellowish white colour, semi-transparent, and of a sweetish taste, but without any perceptible smell; had a firm consistence, and was in small regular masses. By maceration in cold water the dried extract was almost entirely dissolved, and with nitric acid a copious precipitate was formed in the state of white plates, which is the albumen. The products of the distillation of the extract were carbonate of ammonia, a thick fetid reddish oil, carbonic acid, and carburetted hydrogen gases. The carbonaceous matter being burnt, was reduced to white ashes, and appeared to be composed chiefly of phosphate of lime.

From various other experiments to which this matter was subjected, from its solution in water, its coagulation by heat, its effects on acids, alkalies, and other chemical re-agents, it seems to possess nearly the same properties as animal albumen.

7. *Gluten.*

In describing the method of preparing starch from wheat flour, it was observed that a tenacious, ductile, soft, elastic mass remains behind. This substance is gluten.

Gluten is of a grey colour, is remarkable for its ductility and tenacity, has a peculiar smell, but no perceptible taste. By sudden drying, it enlarges in volume, and by the action of heat, it cracks and swells, exhaling a fetid odour, and burns like horn. When moistened and exposed to the air, it dries, becomes hard and brittle, and has some resemblance to glue. It is insoluble in water, but retains a portion of that liquid, to which its elasticity and tenacity are owing. Boiling deprives it of these properties; and when kept moist it runs into fermentation.

Gluten is soluble in all the acids, and is precipitated from this solution by the alkalies. After fermentation, it is soluble in acetic acid, and this solution answers the purpose of a varnish. It is insoluble in alcohol and in ether; but fermented gluten being triturated with a little alcohol and then diluted with the same liquid, may be also employed as a varnish for paper or wood.

From the distillation of gluten, the products of which are water impregnated with ammonia, and an empyreumatic oil, as well as from its spontaneous decomposition, its constituent parts are oxygen, hydrogen, and azote; and as the vapour given out during its fermentation blackens silver, it is inferred that sulphur enters into its composition.

Wheat-flour is composed of a large proportion of gluten, and its property of being formed into bread depends on this substance.

Gluten is found in a great number of plants, and in different parts of vegetables, as in the juice of the leaves of cabbage and cresses, and similar plants, in acorns, chesnuts, barley, rye, peas, and beans, in apples and quinces, in the berries of the elder, and in the grape.

8. *Extractive Matter.*

The word extract, formerly applied in a more extensive sense to the inspissated juices of vegetables, has been limited by modern chemists to a peculiar principle, which is characterised by distinct properties. If a quantity of saffron be infused in water for some time, and if the infusion be filtered and evaporated to dryness, the residue is extract or extractive matter, to which the following properties belong: 1. The taste is acid; 2. A few drops of ammonia throw down a brown precipitate, which consists of lime, and a portion of the extract becomes insoluble; 3. Sulphuric acid disengages the vapour of acetic acid; 4. Quick-lime being added to a solution of extract, separates ammonia; 5. Sulphate of alumina, without excess of acid, poured into a solution of extract and boiled, produces a flaky precipitate, which is insoluble in water, and composed of alumina and vegetable matter; 6. A similar effect is produced with almost all metallic solutions; a brown precipitate is formed with muriate of tin and oxygen; muriatic acid affords a copious dark yellow precipitate; 7. Wool or cotton impregnated with alum, and boiled with a solution of extractive matter, combines with it, and deprives the solution of a good deal of its colour. 8. Extractive matter, distilled in an open fire, yields an acid liquid, which contains a larger proportion of ammonia than when it is distilled with lime or alkali in the humid way; 9. Dissolved in water, and exposed to the open air, extractive matter is entirely decomposed; and after the putrid fermentation, the carbonates of potash, of ammonia, and of lime, remain behind.

The largest proportion of extractive matter exists in old plants. It is found in different parts of the plant; it often forms one of the constituents of the sap, and it may be obtained, it would appear, from all barks which have an astringent property. In the infusion of catechu, it is combined with tannin; and if the powder of catechu be repeatedly washed with water, the liquid which passes off no longer precipitates gelatine, and the residue is extractive matter of a reddish brown colour, without smell, but with a slightly astringent taste.

9. *Colouring Matter.*

Many plants afford colouring matter for the purposes of dyeing, as madder, carthamus, brazil wood, yellow weed, fustic, anatto, and indigo.

The colouring matter of madder is soluble in alcohol, and when the solution is evaporated the residue is of a dark red colour. The precipitate formed in this solution with a fixed alkali is violet, with sulphuric acid fawn-coloured, and with sulphate of potash a fine red.

Carthamus tinctorius affords two colouring matters, one of which, the yellow, only is soluble in water; but the solution is turbid, becomes transparent with acids, and of an orange colour, with a fawn-coloured precipitate with alkalies.

The decoction of Brazil wood affords a red precipitate, inclining to fawn-colour with sulphuric acid; when nitric acid is first added, the solution first becomes yellow, and with another portion of a dark orange-yellow and transparent. Similar effects are produced with muriatic acid.

The colouring matter of logwood is extracted both by water and alcohol, and the solution is of a beautiful red, inclining to violet or purple. When the aqueous solution is kept some time, it becomes first yellow and then changes to black; acids produce a yellow colour, and alkalies deepen it and restore the purple or violet. The stronger acids form a precipitate which separates slowly, and sulphate of iron communicates a bluish colour like ink, with a copious precipitate of the same colour.

Yellow weed, *reseda luteola*, gives a yellow colour, inclining to brown in solution in water. When the solution is diluted, the yellow colour changes a little to green. Acids render it paler, and alkalies increase its intensity.

The decoction of fustic or yellow wood, *morus tinctoria*, in water, is of a dark reddish-yellow colour, becomes orange-yellow with the addition of water; acids render the liquid turbid, and alkalies convert it nearly to a red colour.

Anatto, which is in the form of a hard paste, externally brown, and internally of a beautiful red colour, is prepared from the seeds of *bixa orellana*, by reducing them to powder, adding water, and fermenting the liquid mass. Anatto is more soluble in alcohol than in water, and with the addition of an alkali the solution is promoted, and the colour inclines less to red.

Indigo is obtained from several plants, and has some resemblance to fecula or starch; but the indigo of commerce is chiefly furnished by the *indigofera tinctoria*, which is extensively cultivated in tropical countries for the purpose of extracting the colouring matter. When the plant has arrived at maturity, it is cut down, put into large wooden vessels, covered with water, and allowed to ferment. The putrefactive process which succeeds best at the temperature of 80° soon commences, the water becomes turbid and greenish, ammonia and carbonic acid gas are given out, and the process is completed in the period of from 6 to 24 hours, according to the temperature and state of the plant. The liquid being poured off into flat vessels, is continually agitated till blue flakes appear, and with the addition of lime-water the flakes precipitate to the bottom; a liquid of a yellowish colour is poured off, and the blue precipitate being collected in linen bags, is allowed to drain till it acquire sufficient consistence to be formed into small cakes, which are slowly dried in the shade.

Indigo is also extracted from other plants, as from *nerium tinctorium*, or rose-bay, a plant which grows abundantly in the East Indies, and from woad, *isatis tinctoria*, a native of Britain.

Indigo is a light friable substance, of a deep blue colour and a compact texture; the shade of colour varies from copper, violet, and blue. The lightest indigo is reckoned the best, but it is rarely free from extraneous matters. When it is pure, it is in the form of a soft powder, of a deep blue colour, without either taste or smell; it remains unchanged in the air, and when exposed to heat gives out a bluish red smoke, and burns with a faint white flame; it is insoluble in water, but one part of indigo is soluble in eight parts of concentrated sulphuric acid. Heat is given out during the solution, which requires 24 hours before it is completed. The mixture is black and opaque, but with the addition of water it becomes clear and of various shades of fine blue, according to the state of dilution. This solution is called liquid blue. The action of concentrated nitric acid on indigo is so violent that it sometimes produces inflammation, but by diluting the acid the action is more moderate, and the solution is of a brown colour; crystals supposed to be oxalic acid appear in it, and a brown viscid matter remains behind; muriatic, phosphoric, acetic, and some other acids dissolve indigo precipitated from sulphuric acid, and give a solution of a dark blue colour.

Solutions of the fixed alkalies readily dissolve indigo, when it is precipitated from its solution. The colour of the solution, which is at first green, is at last destroyed. Similar effects are produced by liquid ammonia and its carbonate, and from this action of the alkalies it appears that the indigo is decomposed. Indigo precipitated from its solution, is also dissolved by lime-water. The colour, which is at first green, gradually changes to yellow, and when the solution is exposed to the air the green colour returns, and at last disappears.

From the chemical examination of indigo, its component parts appear to be oxygen, carbone, hydrogen, and azote.

10. *Bitter Matter.*

Many plants are peculiarly characterised by a bitter taste, such as the quassia of the shops, which is employed in medicine, the leaves of the hop-plant, and the flowers of camomile. This bitter taste is ascribed to a peculiar matter which is supposed to be common to the plants now enumerated, and to others which possess similar properties. But it seems probable that a more minute chemical analysis might detect some shades of difference in the bitter matter of different plants, or at least find it so combined with some other principles as to be separated with difficulty.

If the substance called quassia be infused for some time in water, a solution of a yellow colour, and of a very bitter taste, but without smell, is obtained. The water being evaporated with a gentle heat, affords a brownish yellow mass, which has some degree of transparency and ductility; but after some time it becomes brittle.

The taste of this substance, which is considered as bitter matter, is extremely bitter; the colour is brownish yellow; when heated, it softens, swells, and blackens; burns away with little flame, and leaves a small portion of ashes. This matter is very soluble both in water and alcohol; nitrate of silver renders it turbid, and then produces a yellow, flaky precipitate; and acetate of lead gives a copious white precipitate.

11. *Narcotic Matter.*

The peculiar matter which is obtained from the milky juice of the poppy, lettuce, and some other plants, and to which it owes its property of procuring sleep, is salled *narcotic matter.* By others this matter has been called *morphia;* and it is supposed to exist in opium, combined with a peculiar acid denominated *meconic acid,* from the Greek word signifying poppy.

The white poppy, *papaver album,* is cultivated in India and different eastern countries, for the sake of the heads, from which opium is extracted. When the heads are ripe, they are wounded with a sharp instrument; and the milky fluid which flows from the wounds being collected, and the watery parts being evaporated, concretes into cakes, which are in the form of a tenacious substance, of a brownish colour, with a peculiar smell, and a disagreeable bitter taste.

The bitter principle of the substance called *morphia,* is prepared by rubbing together eight ounces of powdered opium and three ounces of strong acetic acid, with a little water, and reducing the whole to a soft pulp. This mass being diluted with two or three pounds of water, the solution is to be strained through a cloth; and the residue being washed with an additional portion of water, is to be strained a second time. The liquid consists of the bitter principle of morphia, combined with acetic acid, or an acetate of morphia, a copious precipitate of which latter substance is obtained by means of ammonia; and when the liquid is evaporated and diminished in bulk, another portion of morphia is thrown down. This matter being separated from the liquid, reduced to fine powder, and digested with a small portion of alcohol, the latter assumes a dark colour, but the morphia is nearly colourless.

Morphia dissolves sparingly in boiling water, but is very soluble in alcohol and ether; and from this solution, which has a very bitter taste, crystals, in the form of four-sided pyramids, may be obtained. This substance seems to possess the properties of an alkali; for it gives a brown colour to paper stained with turmeric, and restores the blue colour to litmus paper, which has been reddened by vinegar, and forms salts with the different acids. The compound with sulphuric acid is very soluble in water, and crystallizes in a branched form; with muriatic acid it exhibits a feathery appearance, but is less soluble in water; and with acetic acid it crystallizes in the form of prisms, which are very soluble.

Morphia melts in a gentle heat, and exhibits in the liquid state the appearance of melted sulphur, and it crystallizes on cooling: it burns readily, and when thrown on burning coals it gives out a copious white flame. The constituent parts of this substance are supposed to be oxygen, carbone, and hydrogen, and, according to others, a portion of azote also enters into its composition.

This narcotic matter exists also in the milky fluids of other plants, of which henbane, *hyoscyamus niger,* is an example, from which a substance, producing analogous effects on the animal economy, is obtained. The effects produced by the leaves of some plants, as those of the deadly-nightshade, foxglove, and hemlock, *conium maculatum,* are ascribed to a similar kind of matter.

12. *Oils.*

Oils are of two kinds, fixed and volatile; and both kinds are obtained from plants. Fixed oils exist chiefly in the seeds of plants, and in those seeds which have double lobes, as lintseed oil, almond oil, and rapeseed oil; and sometimes it is found in the pulp of some fruits, as in that of the olive. Fixed oil, as it exists in these vegetable matters, is mixed with a portion of mucilage, which renders the oil miscible with water, and it is extracted by expression and boiling.

All parts of plants, excepting the seeds, afford volatile oils; in some they abound in the root or the stem, and in others in the leaves, the flower, the pulp, and rind of the fruit. The peculiar odour of plants is ascribed to a volatile oil. These oils are extracted either by expression or by distillation. The prevailing colour of volatile oils is yellow; but some are green, and others are blue.

13. *Wax.*

Wax, of which the combs of bees are formed, is collected from vegetables; and as a substance of the same kind is found in vegetables, such as the varnish of the upper surface of the leaves of some trees, wax, therefore, is to be regarded as vegetable matter.

When wax is pure it has neither taste nor smell; it is unchanged in the air, and is insoluble in water; when unbleached, it melts at the temperature of 142°, but when pure, at 155°, it becomes a colourless transparent fluid, and with an increase of temperature boils, and rises in vapour, which being set fire to, burns with a bright flame. The acids have scarcely any effect on wax, but it is soluble in boiling alcohol, and in ether, with the assistance of heat. On cooling, it is precipitated from both solutions; it is soluble in the fixed oils with the aid of heat. This compound, called *cerate,* is employed in making plasters for dressing wounds. Wax combines with the fixed alkalies, and forms with them a kind of soap.

Wax is extracted from different plants, and particularly from the candleberry myrtle, *myrica cerifera* of America. Myrtle wax is prepared from the berries of the plant, which are collected and put into a kettle with water, to the depth of half a foot, and while heat is applied the berries are pressed against the sides of the vessel, and the wax melts and swims on the top. It is then collected, passed through a cloth, dried, and melted again, and cast into cakes. The wax, it appears, is chiefly deposited in the outer covering of the berries. Myrtle wax is of a pale green colour, melts at the temperature of 109°, burns with a stronger heat, and gives out a white flame, with an agreeable aromatic odour, and with little smoke. In its other properties it approaches nearly to those of bees-wax.

14. *Camphor.*

The camphor of commerce is chiefly obtained from a species of laurel, *laurus camphora,* a tree which grows in Japan and other eastern regions. It is extracted, by distilling the wood with a quantity of water in large iron pots, to which heads of earthen ware, stuffed with straw are fitted; and as the camphor is sublimed, it concretes on the straw in the state of a grey powder. In this state it is brought into commerce; but it is subjected to a second sublimation, which process has been long in the hands of the Dutch.

Camphor thus purified is a white brittle substance, with a hot acrid taste, and a strong aromatic odour; it is not altered by exposure to the air, but is so volatile, that if left in an open vessel it soon disappears. By sublimation in close vessels, it crystallizes in the form of six-sided plates, or pyramids; it is insoluble in water, but communicates some of its odour to that liquid. By the application of sudden heat, if the temperature be about 300°, the camphor melts before it is volatilized. It burns readily with a bright flame, and without leaving any residue; and burns even on the surface of the water.

The acids dissolve camphor, but with the addition of water, or an alkali, it is precipitated without change. The solution in sulphuric acid is red, and in nitric acid yellow; the latter was formerly called *oil of camphor.* By the repeated distillation of nitric acid off camphor, the latter is converted into camphoric acid. Oxymuriatic acid gas passed into a solution of camphor in nitric acid, changes the solution, first to a rose colour, and then to a yellow, which is permanent. Camphor is soluble in water impregnated with carbonic acid gas, and in acetic acid, the latter of which solutions is well known as aromatic vinegar. Alcohol readily dissolves camphor; and from this solution, as well as from its solution in acids, it is precipitated by the addition of water. With the aid of heat, the camphor is soluble in the fixed and volatile oils, but is precipitated on cooling.

Camphor exists in many other plants, as in thyme, marjoram, different species of mint, rosemary, and in the roots of some plants, as ginger; and in these plants it seems to be combined with a volatile oil. The constituent parts of camphor are carbone and hydrogen, the former of which is in larger proportion than in oils.

15. *Caoutchouc.*

The substance called caoutchouc, is chiefly prepared from the inspissated juice of two trees, which are natives of South America; but it is also obtained from other plants. Incisions being made in the bark of the trees, a milky juice flows out, which being collected in proper vessels, and applied gradually to earthen moulds, and dried in the sun, or before a fire, takes their shape, and is imported into Europe in such forms.

Caoutchouc is of a blackish colour, because, in drying the juice, it is usually exposed to smoke; but when it is pure, it is white, has neither taste nor smell, is soft and pliable like leather, is remarkable for its elasticity, and possesses great tenacity. When heated, it melts readily, and assumes the consistence of tar, burns with a bright flame, and diffuses a fetid odour.

Caoutchouc is decomposed by sulphuric and nitric acids; muriatic acid has no action upon it, but oxymuriatic acid or chlorine precipitates it immediately from the milky juice. Caoutchouc is insoluble in alcohol, but it is soluble in ether, if the precaution be observed of previously washing the ether with water, and in this way caoutchouc is formed into different instruments. The volatile oils dissolve caoutchouc, and a mixture of volatile oil and alcohol possesses the same property. This latter solution answers the purpose of a varnish. It is partially soluble in the alkalies, and by distillation affords ammonia, from which, and from its effects on different reagents, the constituent parts of caoutchouc appear to be carbone, hydrogen, azote, and oxygen.

16. *Resins.*

Resinous substances form a numerous and important class of vegetable productions. They are obtained either by spontaneous exudation, or by wounding the bark of trees, or are separated by distillation from volatile oils. When volatile oils are exposed to the air, they grow thick, and are converted into resinous matter, from which it is supposed that resin is a volatile oil saturated with oxygen.

Resinous bodies are solid, brittle, usually of a yellow colour, with some degree of transparency, and of a hot and acrid taste, but without smell; they melt when exposed to heat, burn with a yellow flame, and give out a great quantity of smoke. They are insoluble in water; they are decomposed or dissolved by the acids; are soluble in alcohol and in ether with the assistance of heat, and in some of the fixed and volatile oils. The solutions of the fixed alkalies, either pure or in the state of carbonate, have the property of dissolving resin.

Rosin.—This kind of resin is extracted from different species of the pine tribe; and the resinous matter has received different names. Common turpentine is obtained from the *pinus sylvestris*; Venice turpentine from *pinus larix*; and balsam of Canada from *pinus balsamea*. When the trees are stripped of their bark, a liquid juice which gradually hardens flows out, and which consists of oil of turpentine and rosin. By distillation the turpentine passes over and the rosin remains behind, and when the distillation is continued to dryness the remaining mass is common rosin; but while it is yet fluid, if water be added and strongly agitated, the product is yellow rosin.

Pitch.—This substance is a resinous juice, extracted from *pinus picea* or pitch pine. It is purified by melting, and squeezing it through linen bags, and then it is white or Burgundy pitch; and being mixed with lamp black, forms black pitch.

Mastich.—This is a resinous substance, which is obtained from the *pistachia lentiscus*, a native of the Levant. The fluid that exudes from the tree in consequence of incisions, concretes into yellowish, semi-transparent, brittle grains; it melts when heated, and exhales a fragrant odour; it is soluble in alcohol and the fixed oils, and is much employed as a varnish.

Sandarach.—This resinous matter is a spontaneous exudation from a species of juniper, a native of Africa, and is in the form of brown tears, which are semi-transparent and brittle; it is completely soluble in alcohol.

Labdanam or *Ladanum.*—This resin is the produce of *cistus creticus*, a shrub which grows in Syria, Candia, and some of the Grecian islands. A viscid juice, which exudes spontaneously, concretes after being exposed to the air; it has a fragrant odour, and a bitter taste. Water dissolves a portion of this resin, and when it is distilled some volatile oil appears; it seems also to be partially soluble in alcohol, for when that liquid is distilled off ladanum, it acquires the odour and taste of the resin.

Anime.—This resin is extracted from the locust tree, *hymenæa courbaril*, which is a native of North America; approaches nearly in appearance to copal, but is different from it by its easy solubility in alcohol. It is much employed as a varnish.

Copal.—This resinous matter is extracted from a tree *rhus copallinum*, a native of North America. But the best kind of copal is brought from Spanish America, and is said to be the produce of different species of trees. It is a light brown transparent substance, melts when heated, and is not directly soluble either in alcohol or oil of turpentine, and with difficulty in the fixed oils. Copal forms an excellent varnish, and for beauty and durability is one of the best yet discovered.

By treating copal with oil of turpentine in a close vessel, in which the vapours are confined, the temperature is raised higher, and a portion of the copal is dissolved; and with the addition of a little poppy oil it forms an excellent elastic varnish.

A solution of copal in alcohol may be effected by previously dissolving half an ounce of camphor in sixteen ounces of alcohol, and adding this solution to four ounces of copal in a matrass, which is stopped with a cork, perforated with a pin, to allow the redundant vapours to escape during the application of the heat. When the solution of the copal is nearly completed, the process is stopped, and the vessel must be cool before the cork is removed. This solution affords a colourless varnish. Copal, it is said, is soluble in alcohol, by exposing it to the action of the vapour. A quantity of alcohol is boiled in the bottom of a vessel, at the top of which a piece of copal is suspended; and during the process the copal softens, and falls down like oil into the liquid alcohol.

Lac.—This is a resinous substance which is deposited on different trees by insects in the East Indies. It seems to be the *nidus* or comb of these insects, in which their ova are deposited and protected. Lac appears in commerce in different states. When the small twigs of trees are incrusted with it, it is called *stick lac*; and it is then of a deep red colour, and communicates to water a colouring matter, which is employed as a red dye. When it is scraped off and boiled in water, it becomes of a brownish colour, and then it is called *seed lac*; and when it is melted and forms a thin crust, it is distinguished by the name of *shell lac*.

Lac is to be considered as a more compound substance than some of the other resins; for beside the resinous matter which is soluble in alcohol, it contains colouring matter which is soluble in water, a portion of wax, which resembles myrtle wax, and a portion of gluten, which is nearly allied to the gluten of wheat.

Lac forms the basis of the finer kinds of sealing-wax. Black sealing-wax is composed of lac melted with different proportions of turpentine and ivory black; and for red sealing-wax, vermilion is the colouring matter employed. Lac is also used as the basis of varnishes and lackers.

Amber.—Amber, which is considered by some of vegetable origin, possesses many of the properties of resin; it is a brittle, hard, transparent substance, sometimes colourless, and often of a deep brown or yellow colour; has neither taste nor smell except when it is heated, and then it becomes soft and gives out a fragrant odour, and when strongly heated it burns with scarcely any residue; it is insoluble in water, but partially soluble in alcohol, and the latter solution being concentrated becomes milky when water is added; the precipitate thus formed is a resinous matter. Amber is soluble in the fixed alkalies at a boiling heat; it is also soluble in nitric acid, and sulphuric acid converts it into a black resinous mass.

By distillation amber gives out carbonic acid gas and carburetted hydrogen gas, an acid liquor, and an oil, which is at first thin and transparent, but becomes afterwards darker and thicker, and towards the end of the process, succinic acid, or the acid of amber, is sublimed.

By roasting amber, it is rendered soluble in the oils, and thus becomes fit for varnish. This kind of varnish may be prepared by spreading the amber on a flat-bottomed iron pan, and subjecting it to heat till it melts; it is then to be covered up and set by to cool. The amber has now lost about half its weight, and one part of it may be dissolved in three parts of lintseed oil, with the assistance of a gentle heat. To this solution, when it is nearly cold, four parts of oil of turpentine are to be added; and the clear part, after the sediment has formed, is to be strained through a linen cloth for use.

To the class of resins belongs also a number of other substances, which are employed in medicine or the arts, and some of which have been arranged as a different class of vegetable productions, under the title of balsams; as *dragon's blood*, which is of a dark red colour, and is soluble in alcohol and the fixed oils, to which it communicates a red colour; *Elemi*, of a pale yellow colour, and with a strong fragrant smell; *Opobalsamum*, or balm of Gilead, which is the production of another species belonging to the same genus, under which the tree which yields the *elemi* is arranged; *Benzoin*, in which the resinous matter is combined with an acid, and which is a brittle substance, and when rubbed gives out a fragrant odour; *Storax*, of a brown colour and brittle, with an aromatic taste and a fragrant odour; *Balsam of Tolu*, of a reddish brown colour, and gives out a fragrant smell; *Balsam of Peru*, of the consistence of honey, of a brown colour, an agreeable smell, and an acrid taste; and *balsam of copaiva*, which is transparent, of a yellowish colour, with a pungent taste and disagreeable odour.

17. *Gum Resins.*

Gum resins, as the name imports, consists of a mixture of resinous matter with a portion of gummy and extractive matter; they are not procured by spontaneous exudation, but by wounding the plants which contain them. Gum resins are always in the solid state, are usually brittle and opaque, are softened by heat but do not melt, and are less combustible than the simple resins. They burn with flame, have an acrid taste and a strong smell, are partially soluble in water, and the solution is opaque and milky, and partially soluble in alcohol, and this solution is transparent. They are also partially soluble in vinegar and wine, and in nitric acid, and with the assistance of heat in the alkalies. By distillation they yield a portion of ammonia, from which it appears that azote is one of their constituent parts.

Olibanum.—This gum resin is the produce of *juniperus lycia*, a native of Arabia, and is in the form of transparent brittle grains, of a yellow colour and a peculiar aromatic smell; forms a milky fluid with water, and is entirely soluble in alcohol; does not melt with heat, but takes fire and burns with an agreeable odour; is considered as the frankincense of the ancients, and is still employed in the Greek and Romish churches to diffuse an agreeable fragrance.

Scammony.—This gum resin is extracted from the roots of a climbing perennial plant, which grows in Syria; it is of a dark grey colour, and has a bitter acrid taste, with a nauseous smell; forms with water a greenish milky fluid; is soluble in alcohol; and is employed in medicine.

Euphorbium.—This gum resin is prepared from the milky juice which flows from incisions made in a plant, *euphorbia officinalis*, a native of Ethiopia; it is in the form of small yellow tears, has no smell, and at first no perceptible taste, but produces afterwards a burning sensation in the mouth; it is soluble in alcohol, and is supposed to possess some deleterious properties.

Assafœtida.—This gum resin is extracted from the roots of *ferula assafœtida*, a perennial plant, and a native of Persia; the milky juice which flows out when the extremity of the roots is cut off, is dried in the sun, and is brought to Europe in regular masses of a whitish, reddish, or violet hue; it exhales a strong fetid smell of garlic, has a bitter acrid taste, and is but partially soluble either in water or alcohol.

Ammoniac.—This gum resin is supposed to be the produce of another species of *ferula*, which is a native of Abyssinia and the interior parts of Egypt; it is brought from the East Indies in large masses, which are composed of little lumps or tears of a milky colour, and which, by exposure to the air, becomes yellow; the taste is at first nauseous and sweet, but becomes afterwards bitter, and the smell is peculiar; it does not melt with heat, but when placed on hot coals burns away in flame. With water and vinegar it forms a milky solution, and it is but partially soluble in alcohol.

Myrrh.—This gum resin is brought from the East Indies in the form of tears, and is supposed to be the produce of a plant which grows in Abyssinia and Arabia. The colour is reddish-yellow, and when pure it has some degree of transparency; it has a bitter aromatic taste and a peculiar smell, does not melt with heat, and burns with difficulty; it seems to be more soluble in water than in alcohol,—with the former the solution is yellow and opaque, and with the latter it is transparent. When it is distilled from water, an oil passes over which is heavier than water. When water is added to the solution in alcohol, it becomes opaque.

Galbanum.—This gum resin is obtained from a perennial plant which is a native of Africa, and is prepared from the milky juice which exudes from the old trees, or by making transverse incisions in the stem; it is in the form of whitish yellow tears; has a bitterish acrid taste, and a peculiar smell; forms a milky solution with water, wine, or vinegar, but is scarcely soluble in alcohol; it does not melt with heat, but affords a considerable proportion of oil by distillation.

Gamboge.—This gum-resin is obtained from the *stalagmitis gambogioides*, a tree which is a native of Siam and Ceylon. In Siam it is procured in drops, by breaking the leaves and young shoots, and hence it is supposed to derive the name of *gum-guttæ*. It is usually brought from the East Indies in cakes or rolls; it is of a yellow colour, opaque and brittle; has no smell and little taste, but leaves a slight sense of acrimony when kept in the mouth. With water it forms a yellow turbid solution, and is almost entirely soluble in alcohol. It is employed in medicine, and is familiar as a yellow paint.

18. *Wood.*

By boiling a piece of wood in a large proportion of water till it no longer give out taste or smell, and then by digesting it in alcohol, the substance which remains is the woody fibre, or basis of the plant. It is usually of a fibrous texture; is more or less coloured; has neither taste nor smell, and is insoluble in water or alcohol.

When the woody fibre is heated in contact with the air, it blackens, exhales dense, acrid, pungent fumes, and the remaining coaly matter retains the original form. When it is reduced to ashes, it is found to contain a little potash, sulphates of potash and lime, and phosphate of lime; and distilled in a retort, it yields water, acetic acid contaminated with oil, a thick oily matter, carburetted hydrogen, and carbonic acid gases, and a portion of ammonia united with acetic acid.

By the action of nitric acid on *quinquina*, which resembles the woody fibre, in an experiment conducted by Fourcroy, more than one-half was converted into oxalic acid, and a portion of citric, malic, and acetic acids appeared, with some azotic gas and carbonate of lime. The constituent parts of wood, therefore, are oxygen, carbone, hydrogen, azote, and lime. The relative proportion of wood which exists in different plants is estimated by the quantity of charcoal which they afford. From the black ash 25 parts were obtained, from pine 20, from heart of oak 19, and from white ash 17.

19. *Tan.*

Tan forms a constituent part of vegetable substances, and is found in considerable proportion in oak-bark and nut-galls. If a quantity of nut-galls be reduced to coarse powder, and infused in water till it is saturated, and this solution being boiled to dryness, a substance remains, which is *tan*, or *tannin*. It is a brittle substance, of a brown colour, has a very astringent taste, and is soluble in water and alcohol, to both of which it communicates its colour and taste. When heated it becomes black, gives out carbonic acid gas, and burns in the open air, leaving a small portion of residue, which is lime.

Tan is precipitated from the infusion of galls by sulphuric, nitric, and muriatic acids, and forms with them compounds which are soluble in water. The alkalies also combine with tan; and the compounds thus formed are also soluble in water. With potash, or soda, the solution is reddish brown, and is deprived of the property of precipitating gelatine. The earths also combine with tan, and yield compounds, which are chiefly insoluble in water. The metallic oxides form compounds with tan, which are nearly insoluble in water; and similar precipitates are obtained by means of many of the metallic salts. No precipitate appears with the green sulphate of iron; but the precipitate with red sulphate is deep blue, and becomes black by exposure to the air. This precipitate is the base of writing-ink.

Tan forms an insoluble compound with gelatine or glue; and on this principle depends the process of tanning leather, which is to be regarded as a compound of tan and gelatine.

Tan is chiefly found in the bark of trees; and the greatest proportion is obtained from the inner bark; but the quantity varies with the age and the size of the tree, as well as with the season. The leaves, the wood, and the sap, afford a portion of tan; and sometimes it is thrown off by spontaneous exudation. Several varieties of tan seem to exist in different vegetable substances, as in catechu, dragons-blood, sumach, and fustic.

20. *Cork.*

A peculiar vegetable substance, called suber, or cork, constitutes the epidermis, or outer covering of trees, and is analogous to common cork, which is the epidermis, or rather a fungus excrescence of a species of oak, the *quercus suber*. It is a light, soft, elastic substance; is insoluble in water, but readily absorbs that liquid; it is very combustible, burns with a white vivid flame, and leaves behind a voluminous mass of coaly matter; and by distillation it yields ammonia.

By the action of nitric acid, carbonic acid and nitrous gas are given out; the cork is decomposed, and converted partly into a yellow, soft, unctuous matter, which is so light as to swim on the surface, and partly into a peculiar acid called suberic acid.

21. *Alkalies.*

Fixed alkalies only have been detected in plants;

for although ammonia appears in the distillation of some vegetables, it is supposed to be a product of the process, and there are few plants which do not yield a smaller or greater proportion of these alkalies.

Potash, which was formerly called vegetable alkali, as it was supposed to exist only in vegetables, is found in all plants, excepting those which grow near the sea. It is extracted from vegetables, by reducing them to ashes by burning, lixiviating the water, and evaporating the solution to dryness.

Shrubby and herbaceous plants afford a larger proportion of ashes than trees; and the branches of trees yield more ashes than the trunk, while the leaves give a greater proportion than the branches. The quantity of ashes obtained from different plants, and the quantity of potash from these ashes is very different.

All marine plants, as well as those which grow near the sea shore, furnish soda, and the proportion which many of them yield is very considerable. Nearly 20 parts of ashes, from which may be extracted about two parts of soda, may be obtained from one hundred parts of salsola soda. Two species of *salsola, sativa, and vermiculata*, which grow abundantly on the shores of the Mediterranean, are the chief sources of the soda of commerce. But the soda or kelp manufactured on the shores of Britain is prepared from different species of *fuci*.

22. *Earths, &c.*

Lime, silica, magnesia, and alumina have been detected in vegetables. Lime is found in most plants, and is the most abundant of the earths in vegetables. Silica has been traced in several plants, and chiefly in the epidermis, which in some is almost entirely composed of this earth. Magnesia is more rarely found in plants, and has been detected only in sea plants. The quantity of alumina found in vegetables is very small.

Iron and manganese are the only metallic substances which have been found in plants. Iron has been detected in the ashes of salsola, and manganese in the ashes of the pine, marygold, vine, and fig-tree.

Chap. V. Animal Substances.

Animal substances, which constitute the second division of organised matter, are distinguished from vegetables by their texture, form, and component parts; but the locomotive power of animals, irritability, and sensibility, present the most characteristic differences. Animal matters are subject to the putrid fermentation; they are all soluble in the alkalies; sulphuric acid reduces them to carbonaceous matter, and carbone is precipitated, while ammonia is disengaged; and nitric acid produces a violent action with the evolution of azotic gas. In treating of animal matters, the functions of living animals, their decomposition when these functions cease to operate, and their component parts may be shortly considered in separate sections.

Sect. I. *Functions of Animals.*

In considering the functions of the living animal, as far as they are susceptible of explanation on chemical principles, the attention of chemical philosophers has been directed to respiration, digestion, secretion, and assimilation.

1. *Respiration.*

As no animal can exist, even for the shortest time, when respiration is interrupted or suspended, it is to be regarded as one of the vital functions. In the mechanical part of this function, the air is alternately drawn into the lungs, and expelled from that organ. No kind of air is fit for respiration which is entirely destitute of oxygen gas; and it appears from experiment, that the proportion of oxygen gas in the air of the atmosphere is the most proper for the support of animal life, for when it is in larger proportion, it seems to be too stimulating, and when it is diminished, injurious effects also follow.

Of the quantity of air respired by different kinds of animals, and even by the same kind of animals, the results of experiments are so different, that no certain conclusion can be drawn from them. The same remark is applicable to the number of respirations which are made even by healthy persons in a given time. From 14 to 27 respirations have been reckoned in a minute, a difference so great that little dependence can he placed on this mode of estimating the quantity of air respired.

The air which is thrown out of the lungs by expiration, has undergone a very material change. It consists of azotic gas, carbonic acid gas, and water in the state of vapour.

As the blood is the source from which are derived the materials for repairing the waste of the body, it becomes necessary that means should be provided for the supply of this waste. This is effected by the process of digestion, the product of which is conveyed to the blood. But before this matter can be converted into that fluid, it must undergo certain changes, which are known only to take place in the lungs. In the course of its circulation through the lungs, the blood acquires a bright red colour, and at the same time, it acquires a constituent part of animal bodies, called *fibrina*, which cannot be detected in the substances which are conveyed to it, to repair its waste, and hence it is concluded to be one purpose of the function of respiration, to form the *fibrina* of the blood. But it seems to be also another great purpose of respiration in the animal economy, to preserve that degree of temperature which is necessary for the health and life of the animal. The quantity of air inspired corresponds in some degree with the heat of the animal. The lower orders of animals, as insects, fishes, and amphibious animals, require but a small proportion of air, and hence it is, that their temperature is little higher than the medium in which they live, and hence, too, they are called *cold-blooded animals*. The temperature of the *warm-blooded animals* is from 96° to 104°. The temperature of man is about 98°, and that of birds, is 5 or 6 degrees higher; and it is found, that this latter class of animals requires a greater proportional quantity of air.

2. *Digestion.*

The food, or nourishment which is taken into the body, is destined for the supply of the waste to which consumption of the blood from which this waste is supplied. According to the nature and constitution of animals, and the circumstances in which they are placed, they require different kinds of food; some of them live entirely on vegetables, others are confined exclusively to animals, and a third class lives indiscriminately both on vegetables and animals; but whatever be the nature of the food or of the animal, it is converted, by the process of digestion, into the same uniform substance. When the food is taken into the mouth, it is broken down, if necessary, and being mixed with the saliva, is conveyed to the stomach, where having remained for a short time, it is converted into a pulpy substance, called *chyme*. This change is effected by means of the *gastric juice*, a peculiar fluid which is secreted in the stomach. Of the nature of this liquid, and of the nature of the process, much speculation has prevailed among physiologists.

The *chyme* passes from the stomach to the other digestive organs, where it is mixed with other substances, and undergoes new changes, for it is converted into a milky fluid, called *chyle*. This chyle is taken up by a set of vessels, called *lacteals*, by which it is conveyed to the circulating mass of the blood.

3. *Assimilation.*

By the processes of digestion and respiration, the nourishment taken into the body is converted into blood, which furnishes those supplies of new matter that are required for the formation of new parts, or to make up the general decay of the system. Supplies of new matter are peculiarly necessary to young animals, in which the parts already formed encrease in size and consistency, and in which entirely new parts are evolved. The process by which the different substances furnished by the blood, for the repair of some parts, and the formation of others, is conducted, is called *assimilation*, because, by a new series of actions and combinations, matter, exactly similar to the parts repaired or renewed, is deposited, and which does not previously exist in the blood. These changes are effected by peculiar organs or vessels, and by their actions the same matter is always separated from the blood while the animal continues in a healthy state. The glands or vessels of the skin secrete perspirable matter, and the saliva is prepared by the glands of the mouth, while the matter of bones or of muscles is separated and deposited in those places where it is required.

Nothing can be more wonderful than the power of the animal system, in deviating from its ordinary course, and in accommodating itself to particular circumstances. In certain cases new actions are induced, or such as in their ordinary state are feeble and limited, become stronger and more extensive. In this manner a part of the body, which has been destroyed or removed, is completely renovated. By this new or extended action, when the body is in a vigorous state, a large piece of muscle is soon renewed; but what is still more extraordinary, the constituent parts of bone are prepared and deposited in those places where large pieces of that substance have been removed; and when the purpose of nature is fully answered, the action ceases.

In one view, all the processes which are going on in the animal system, may be considered of a chemical nature; but they are subject to the controul of some power, the characteristics of which are altogether different from those of a chemical or mechanical agent. This power is the living principle, which regulates, directs, and in some degree counteracts the effects of chemical agents. Of the existence and controul of this power, a strong proof is adduced from what happens when its action ceases, or when life is extinct. The constituent parts of animal bodies begin immediately to decompose each other, to enter into new combinations, and to appear under new forms.

3. *Secretion.*

In the course of the circulation of the blood, different substances are separated from it, some of which are destined for the nourishment and growth of the body, or for the repair and supply of those parts which are destroyed; and other substances, which either seem to be superfluous, or, if retained, might prove injurious, are thrown out of the system. These substances are separated by particular organs; and the process is called secretion. Thus, the saliva is secreted by certain glands, and poured more copiously into the mouth during the action of eating, when it is more necessary. By the action of other glands, milk is secreted for the nourishment of the young animal; and by means of a set of vessels on the skin, or surface of the body, the process of perspiration, so necessary to its healthy state, is conducted.

Sect. II. *Decomposition of Animal Substances.*

A remarkable difference exists between the spontaneous decomposition of animal and vegetable bodies. From the greater variety of the constituent principles of animal matters, a greater variety of action, and more numerous and complicated attractions take place, and a greater variety of new products make their appearance. One of the most striking characters which distinguishes the decomposition of animal matters is, the rapidity of the process which is called putrefaction. It is not marked by different stages, as in the decomposition of vegetables, or the different changes in its progress are not perceptible.

But certain circumstances are necessary to promote the mutual action of the constituent principles of animal matters, and thus to contribute to the putrefactive process, or their total decomposition. Moisture and moderate heat are the chief circumstances necessary for the putrefaction of animal matter. No change takes place on dry animal matters; but the soft parts of animals, especially the liquid parts, and even the bones when kept moist with water, rapidly undergo the putrefactive process. Heat is also a requisite condition in promoting these changes. At the freezing temperature or below it, no putrefaction is observed to take place in animal matters; and in proportion to the rise of temperature within certain limits, the changes proceed with more or less rapidity; but when the temperature is so high as to carry off the moisture, the process is retarded, or altogether interrupted.

Animal matters being placed in favourable circumstances, the solid parts become soft, and the liquid parts more fluid; the colour changes to reddish brown or deep green; an offensive odour is exhaled; the liquids become turbid; the soft parts are converted into a kind of jelly, and the whole mass is enlarged in bulk, arising from the escape of elastic fluids, which are slowly evolved. The whole matter is then reduced to one uniform mass; the bulk is diminished, and the colour becomes deeper; towards the end of the process, a peculiar, and somewhat aromatic odour is given out; and when it ceases, an unctuous, viscid, and fetid earthy mass remains behind.

The duration of the putrefactive process is very different, according to the nature of the substances and the circumstances in which they are placed. The elastic fluids which are given out during this process are carburetted, sulphuretted, and phosphuretted hydrogen gases, and water in the state of vapour, and to the three first it is obvious the offensive smell is owing. The other products which make their appearance at different periods of the process are of a more fixed nature; among these products are a kind of soap, formed of unctuous matter and ammonia, nitric acid, which is usually combined with an earthy or alkaline base, and an unctuous earth, which remains after the separation of the other matters.

The prevention of the process of putrefaction in animal matters which are to be preserved for food or other purposes, is an object of great importance in domestic economy. This object may be attained by depriving the animal matters entirely of moisture, without which the process cannot go on; the same object is attained by keeping them at the freezing temperature or below it; and animal matters may be preserved by covering them up with such substances as readily combine with water, and thus prevent its effects in promoting the putrefactive process. In this way it is supposed acids, alcohol, sugar, and some salts, obviate putrefaction; and, with the same view, aromatic and resinous substances, volatile oils, camphor, and the dried powder of astringent and fragrant plants are employed.

Sect. III. *Component Parts of Animal Substances.*

After the account which has been given of the functions of living animals, and of the spontaneous decomposition to which they are subjected after death, it is now necessary to take a view of their component parts, as they have been the subjects of chemical investigation.

I. *Constituent Parts of Animal Substances.*

The simple substances of which the different parts of animals are composed, are chiefly azote, carbone, hydrogen, and oxygen, which, in different proportions, enter into the composition of the soft parts; phosphorus and lime, which constitute the base of the bones; sulphur, the fixed alkalies, muriatic acid, iron, and manganese. But the constituent parts of animals are to be considered as those substances into which they are resolved by certain processes, and which exhibit peculiar characters. Some of these substances are simple, and some are of a compound nature.

1. *Gelatine.*

Gelatine may be prepared by repeatedly washing the fresh skin of an animal in cold water, boiling it, and reducing it to a small quantity by slow evaporation. When it cools it forms a solid, tremulous mass, called jelly; and when dried in the air it becomes hard and semi-transparent. Common glue is gelatine in an impure state.

When pure, gelatine is colourless and semi-transparent, is brittle, breaks with a vitreous fracture, and has neither taste nor smell; when heated in the dry state it first becomes white, then blackens, and is converted into a coaly matter. It remains unchanged in the air, but the solution in water is soon decomposed.

With the aid of heat, gelatine is readily dissolved by the acids; with sulphuric acid a brown solution is formed, and sulphurous acid is given out; nitric acid is decomposed; azotic gas first appears, and is succeeded by a copious evolution of nitrous gas, while the gelatine is dissolved and partly converted into oxalic and malic acids; and with muriatic acid a brown coloured solution is formed, from which a white powder is precipitated.

The alkalies readily dissolve gelatine with the aid of heat, and some of the metallic oxides form precipitates with it in its solution in water, and the compound thus formed is insoluble.

Gelatine produces a copious white precipitate with tan, and the compound, which is brittle, remains unaltered by exposure to the air.

The component parts of gelatine are carbone, hydrogen, azote, and oxygen, and some traces of phosphate of lime and of soda. Gelatine forms a chief part both of the solid and fluid parts of animals; it is found in the bones, ligaments, and skin, and also in the blood and in the milk.

It appears that there are various kinds of gelatine, arising either from slight variations of the proportions of the constituent parts, or from the addition of other substances. Glue is extracted from bones, muscles, and membranes, but chiefly from skins; and the strongest glue is prepared from the skins of old animals. Size, a weaker kind of glue, which is colourless and transparent, is obtained from the skins of eels, rabbits, and from some kinds of white leather; and isinglass, another kind of glue, is prepared from different parts of the sturgeon, and other kinds of fish.

2. *Albumen.*

The greater part of the white of an egg is composed of albumen, but it is combined with a portion of soda and sulphur. When it is heated to the temperature of 165°, it coagulates into a solid white mass. This is considered its characteristic property, and it has undergone an entire change, for it is not now soluble in water. The cause of this coagulation has been ascribed by some chemical philosophers to the absorption of caloric, by others to the absorption of oxygen; by some to the extrication of caloric, and by others to a different arrangement of its particles.

Before coagulation, albumen is a glary liquid, without smell, and with scarcely any taste, becomes brittle and transparent when dried in a moderate heat; and in this state it is not changed by exposure to the air. It is coagulated by the acids, and by alcohol and ether, if not too much diluted with water. It is precipitated from its solution in water by many of the metallic salts, and tan throws down a copious white matter.

After coagulation, albumen is a tough, opaque substance, of a pearly white colour, and a sweetish taste, insoluble in water, and less liable to change. Dried in the temperature of 212°, it becomes a hard, brittle yellowish substance, with some degree of transparency. When digested in water it becomes soft, white, and opaque; a portion seems to be dissolved, but the infusion of tan produces no precipitate. The mineral acids when largely diluted with water dissolve a small portion, and it is readily dissolved in a boiling solution of potash. During this process ammonia is evolved, and a soap is formed. By the addition of muriatic or acetic acid, with the solution of this soap in water, a precipitate also having the properties of soap is formed.

The constituent parts of albumen appear to be carbone, hydrogen, azote, and oxygen; and it is supposed by some that the greater proportion of azote in albumen gives it its characteristic properties, and distinguishes it from gelatine. It constitutes an essential part of bones and muscles, and it is the chief constituent of cartilage, horns, and hair.

3. *Fibrina.*

The clot which is formed and falls to the bottom when blood is drawn from an animal, remains for some time at rest; being put into a linen cloth and repeatedly washed with water, till it come off insipid and colourless, the fibrous part, or the *fibrina*, remains behind. Fibrina is also prepared by cutting lean beef into small pieces, macerating in water for 15 days, the water being changed daily, and squeezed out by pressure; then boiling the muscular substance five hours every day, for three weeks, in a fresh portion of six quarts of water, and after pressing the fibrous substance, drying with the heat of a water bath. The remaining matter is *fibrina*, nearly in a state of purity.

Fibrina is of a white colour, soft and elastic, when it is recently separated from blood, and as it dries the colour becomes deeper; but when it is prepared by boiling and maceration from muscular matter, it is brittle, and has some degree of transparency; it has neither taste nor smell, is insoluble in water and alcohol, and remains unchanged in the air. Exposed to heat it suddenly contracts, gives out the smell of burning feathers, melts when the temperature is increased, and affords by distillation, water, carbonate of ammonia, a thick fetid oil, carbonic acid, and carburetted hydrogen gas, with some traces of acetic acid. In the coaly matter which remains behind, phosphate of soda, and phosphate and carbonate of lime are found.

Fibrina is soluble in the acids; with sulphuric acid, the solution is of a deep brown colour, charcoal is precipitated, and acetic acid formed. By the action of diluted nitric acid, a copious evolution of azotic gas takes place, and being kept for some time in the same acid, diluted with three times its weight of water, a solution of a yellow colour, resembling the solution of albumen, is formed. The product of this solution being dissolved in boiling water, and concentrated by evaporation, is converted into gelatine, which is soluble in hot water, and is precipitated by tan. When concentrated potash or soda is boiled with fibrina, a deep brown coloured solution, having the properties of soap, is obtained, and during the process ammonia is evolved.

The component parts of fibrina are carbone, hydrogen, azote, and oxygen, and it forms a constituent part of the blood and muscular parts of animals.

4. *Sugar.*

Sugar, as it has been extracted from milk, is to be enumerated among animal productions. It is prepared from milk, by reducing fresh whey by evaporation to the consistence of honey. When it has cooled, it concretes into a solid mass, which being dissolved in water, clarified with the white of eggs, filtered, and evaporated to the consistence of syrup, affords, on cooling, crystals of sugar of milk.

When this kind of sugar is pure, it is of a white colour and semi-transparent; has a sweetish taste, but no smell, and is soluble in seven times its weight of water.

By the action of heat and by distillation, the same effects and the same products appear as from vegetable sugar, excepting that the empyreumatic oil has the smell of benzoic acid. It is insoluble in alcohol, but it may be dissolved in that liquid by means of sulphuric acid. By means of nitric acid, the sugar of milk is converted into saclactic acid; and it is said that this sugar is not susceptible of the vinous fermentation.

The sugar from honey, which may be considered partly as an animal production, is of a white or yellowish colour; has a sweet taste, and an aromatic odour. This sugar is very soluble in water; runs into the vinous fermentation, and, when heated with nitric acid, affords oxalic acid, like vegetable sugar.

5. *Oils.*

The animal oils, which have all the characters of fixed oils, sometimes exist in the solid state, and sometimes in the form of liquid. Fat has different degrees of consistence, as it is obtained from different animals. When it is purified, by dividing it into small pieces, washing with water, and separating the membranous parts, and then melting it in a shallow vessel with some water, till the latter is evaporated, it becomes of a pure white colour, having neither taste nor smell.

Fat, as it is obtained from different animals, melts at different temperatures; hogs-lard requires only a heat of 97°; while the fat extracted from meat by boiling requires a temperature of 127°. When the heat is raised to 400°, a white smoke is given out; and with the increase of the temperature it is decomposed and becomes black. By distillation, hogs-lard gives out carburetted hydrogen and carbonic acid gases, accompanied with a very offensive smell; a portion of water is also obtained, and a whitish oil, which concretes in the receiver, in which also acetic acid and some sebacic acid are also found mixed with the oil.

Fat is insoluble in water and alcohol; it is dissolved and decomposed with the stronger acids; and by the action of nitric acid, with a little heat, the fat is converted into a yellow coloured ointment, while the acid itself is decomposed. This ointment has been called an oxide of fat. The alkalies combine with fat in the same way as with other oily substances, and form soap.

From the products obtained by the decomposition of fat, it appears that its constituent parts are oxygen, hydrogen, and carbone.

Some other oily substances are extracted from different parts of animals; as spermaceti from the head of the spermaceti-whale; spermaceti-oil, which is separated in the purification of spermaceti; and train-oil, which is extracted from the blubber of the whale, and from other sea-animals.

6. *Resins.*

Substances, resembling, in some of their properties, vegetable resins, are found in different parts of animals, or rather they exist in some of those substances which are secreted by animals.

A resinous substance of this character is extracted from the fresh bile of the ox, by means of muriatic acid; is of a dark brown colour; has a very bitter taste; melts at the temperature of 122°; is soluble in cold and hot-water; and in alcohol forms a soap with the alkalies, and is precipitated from all these solutions by diluted acids.

Ambergrise, a concreted matter, supposed to be formed in the stomach of the spermaceti whale, is so light as to swim on water; is of an ash-grey colour; is insipid to the taste, but has an agreeable smell; it melts at 122°; and when the temperature is increased to 212° it is almost entirely dissipated in white vapour; it is insoluble in water; is not much changed by the acids, but is soluble in alcohol and in ether, in the fixed and volatile oils; and with the alkalies, when assisted by heat, it forms a soap.

Civet, which is a production of the civet-cat, is of a yellow colour, a soft consistence, and, when it is mixed in small proportions with other substances, has an agreeable odour. It is said to be insoluble in alcohol, but dissolves readily in oils, and is well known as a perfume.

Musk is also an animal secretion, of a brownish red colour, with a bitter taste, and a very strong aromatic smell; is partially soluble in water and alcohol; but the former only retains the smell of the musk. It is also soluble in sulphuric and nitric acids, and seems to undergo some decomposition, for it is deprived of its odour. The fixed alkalies seem also to produce its decomposition, for by their action ammonia is given out.

Castor, which is secreted by the beaver, and is nearly fluid when it is taken from the animal, hardens in the air, and is of a yellow colour, with a bitter acrid taste, and a strong aromatic odour; becomes soft in water, and communicates a pale yellow colour to the liquid, which converts vegetable blues to green, indicating the presence of an alkali.

7. *Phosphorus, Sulphur, and Acids.*

The putrefaction of animal matters, during which phosphuretted hydrogen gas is given out, affords sufficient proof that phosphorus must have entered as a constituent into these bodies.

Sulphur is always met with in albumen; it has been detected in milk and in the white of eggs, in the blood, in the muscles, and in hair.

Not fewer than twelve different acids have been detected, ready formed, in animal bodies. Sulphuric acid, combined with soda and with lime, is found in some animal fluids; muriatic acid, in combination with soda, is rarely absent from any of the liquid animal secretions; phosphoric acid, forming phosphate of lime, which constitutes the base of the bones, exists also in almost all the solid parts, and in the blood it is combined with iron; and the other acids, as the carbonic, the acetic, oxalic, malic, benzoic, lactic, uric, rosacic, and amniotic, are found either forming compounds with other substances, or uncombined, in animal fluids; and some of them, as oxalic and uric acids, are met with in calculous concretions.

8. *Alkalies, Earths, and Metals.*

The different alkalies exist in animal fluids; potash has been found in milk; soda, usually mixed with albumen, is met with in all the fluids, and ammonia is extracted from some of them.

Lime, magnesia, and silica, are the only earths which have been detected in animal bodies. Lime, with phosphoric acid, forms the basis of the bones, is also met with in the same state of combination in other solid parts, and in most of the fluids; magnesia, forming a triple salt with phosphoric acid and ammonia, exists in some of the fluids, and is a component part of calculous concretions; and silica has been detected in similar morbid concretions.

Of metallic substances, iron only has been found in animals; and, in combination with phosphoric acid, it forms one of the constituent parts of the blood.

II. *Fluid Parts of Animals.*

The parts of animals are either fluid or solid; and the fluid parts, as the blood, bile, milk, saliva, and some others, may be first treated of.

1. *The Blood.*

Human blood, and that of some other animals, is of a fine purplish red colour, feels soft and soapy, has a sweetish saline taste, and a peculiar odour. When drawn from the body, and left at rest for some time, it separates into two parts, one of which, called the clot or cruor, coagulates, and retains its red colour; and the other part, called the serum, continues fluid.

The acids coagulate blood, and the alkalies dissolve the coagulum; and if they are mixed with blood recently drawn, they prevent the coagulation. Metallic oxides, which readily part with their oxygen, coagulate blood, and a similar effect is produced by almost all metallic solutions. Many vegetable substances, as sugar, camphor, and resins, when mixed with blood, prevent its putrefaction; solutions of gum, and of starch, produce a coagulation, and a copious precipitate is produced by tan, and gallic acid strikes a black colour with it.

The serum of blood is of a pale, greenish, yellow colour, of a thinner consistence than blood, but retains the taste, smell, and soapy feel. When raised to the temperature of 156° it coagulates; and the same effect is produced by the addition of boiling water. The serum of blood contains muriate of soda, carbonate of soda, and phosphate of lime; and by diluting it with water and boiling it, the albumen is coagulated, while the remaining liquid, being concentrated by evaporation, is converted into gelatine.

The cruor, or clot of the blood, is of a red colour, and has a greater degree of consistence. If it be washed with a small quantity of water till the water pass off colourless, the fibrina remains behind, and the colouring matter is carried off by the water. The watery solution converts vegetable blues to green, and when it is evaporated the residue is found to contain albumen and soda. If this watery solution be evaporated to dryness with a moderate heat, a portion of iron remains behind, and may be separated by the magnet. The iron, as it exists in the blood, is in the state of oxide, combined with phosphoric acid.

Blood dried with a moderate heat exhales a portion of water, which possesses a peculiar odour; and if the blood thus dried be distilled, a watery fluid is first driven off, and afterwards carbonic acid gas, carbonate of ammonia, a fluid oil, carburetted hydrogen gas, and an oily matter of the consistence of butter. By means of this watery fluid, a green powder is precipitated from sulphate of iron; a portion of this powder is soluble in muriatic acid, and a small quantity of Prussian blue remains behind. These effects indicate the presence of prussic acid and an alkali in the watery liquor.

The constituent parts of the blood present considerable variations at different periods of life; and the blood of persons labouring under inflammatory disorders seems to have changed some of its properties.

2. *Bile.*

The bile, which is secreted from the liver, and seems to perform an essential part in the function of digestion, is of a yellowish-green colour; has a peculiar odour, a bitter taste, and a soapy feel. But the bile of different animals varies in some or all of these properties.

When bile is strongly agitated, it froths up and forms a lather like soap, and hence has been called animal soap; it mixes readily with water, to which it communicates its yellow colour. When moderately heated it becomes thick, exhales a peculiar offensive odour, and the remaining mass becomes solid; is of a brown colour; has a bitter and somewhat sweetish taste; softens and becomes ductile with the heat of the hands; attracts moisture from the air, and is soluble in water; it effervesces slightly with acids, and acquires a perceptible smell of musk or amber when kept. This substance has been called *extract of bile*.

The acids decompose bile, throw down a precipitate of a greenish colour, and by agitation dissolve part of this precipitate. By the action of acids on bile, three different saline substances are obtained, one of which has soda for its base, the other is a calcareous salt, and a third is a crystalline matter resembling sugar. The acids coagulate, and precipitate the albumen of bile; combine with the soda, by separating the oily matter which forms the soapy part of the bile, and decompose the phosphoric salts. The alkalies deprive bile of its bitter taste, but do not coagulate it.

3. *Milk.*

Milk is secreted in particular organs by the females of viviparous quadrupeds and cetaceous fishes, and is destined for the nourishment of the offspring in the early period of its existence. It is a white opaque fluid, varying in its density and other properties in different species of animals, and varying also in the same species according to the nature of the food.

The milk of the cow, which has been chiefly the subject of chemical investigation, is distinguished by a peculiar odour and an agreeable sweet taste, when it is first drawn from the animal; for after a few hours its properties are considerably changed. When allowed to remain some time at rest, it separates into an unctuous matter called cream, which collects on the surface, and a denser fluid, which retains many of the properties of milk.

Cream is of a yellow colour, becomes thicker when exposed to the air; is lighter than water; has an unctuous feel, and grows rancid, like oils, by keeping; it is not soluble in alcohol or in oils; and by agitation for a longer or shorter time it separates into two parts, one of which is *butter*, having a solid consistence, and the other remains liquid.

Butter, which is of a yellow colour, possesses all the properties of an oil, combined with a portion of the curd and serum of the milk; melts at the temperature of 96°; mixes readily with other oily matters, and becomes rancid by keeping—a change which is ascribed to the whey and the curd, for when these matters are separated it may be preserved sweet for a much longer time. By distillation butter yields water, an acid liquid, an oily substance, which is at first fluid and becomes afterwards concrete, and a portion of carbonaceous matter remains behind.

If fresh cream, or the whole of the milk as it is fresh drawn from the cow, be churned, it requires a much longer time to produce the separation of the butter than when the cream or milk is kept till it acquire a slightly acid taste. But if cream which has become sour be churned, the butter separated has no acid properties, and even the milk which remains is less sour than the cream before the process commenced. From these facts it is inferred that an acid is evolved, and this acid is supposed to be the carbonic.

The milk which remains after the separation of the cream, may be coagulated by the addition of different substances, and particularly by means of rennet, which is most commonly employed, and is prepared by digesting the inner coat of the stomach of young animals, especially that of the calf. The coagulum thus formed separates into two parts, the curd, and the serum, or whey. Milk may be coagulated also by acids, alcohol, neutral salts, gum-arabic, and sugar.

Curd is a white solid substance, which has some degree of brittleness when the whole of the whey is separated, and is soluble in concentrated vegetable acids and in diluted mineral acids. Cheese is prepared from curd, by separating the whey by expression. The richness of the cheese depends on the quantity of cream which remains in the milk; and the best cheese is obtained when the milk is coagulated at the temperature of 100°, and the whey is slowly and gradually expressed from the curd without breaking it down.

The serum, or whey, is of a yellowish green colour, and has an agreeable sweet taste. By boiling, another portion of curd separates, and being left at rest the whole is precipitated, and the liquid remains transparent and colourless. By the slow evaporation of this liquid, a saccharine matter, in whitish coloured crystals, is deposited with some saline matter. Whey, by keeping, becomes sour by the formation of an acid, which is lactic acid; and to this acid the spontaneous coagulation of milk is ascribed. When milk which has become sour is kept for some time, it undergoes the process of fermentation, and a vinous intoxicating liquor is thus obtained, which has been long known among the Tartars by the name of *koumiss*, and is prepared by them from the milk of the mare. Milk is also susceptible of the acetous fermentation. By adding six spoonfuls of alcohol to eight pints of milk; and, excluding the liquid from the air, while the carbonic acid gas evolved is allowed to escape, vinegar is formed in the course of a few weeks.

4. *Saliva.*

The saliva which is secreted by peculiar glands, and flows into the mouth, is a clear viscid fluid, generally of a frothy appearance, from being mixed with air, and has neither taste nor smell. When it is boiled, albumen is separated, and by slow evaporation muriate of soda is obtained. By the action of the acids and of alcohol, it becomes thick, and oxalic acid precipitates lime. It is decomposed by the alkalies, and muriatic and phosphoric acids are precipitated by nitrate of lead, of mercury, or of silver. The saliva of different animals seems to possess different properties, as that of the horse, which is of a greenish yellow colour, has a disagreeable smell, a saline taste, and a soapy feel.

5. *Tears and Mucus.*

The tears which are secreted by the lachrymal glands for lubricating the eye, are transparent and colourless, and have a saline taste, but no perceptible smell. This liquid converts vegetable blues to green, and when evaporated to dryness, cubic crystals of common salt appear; it is soluble in water and in the alkalies, and alcohol produces a white flaky precipitate. The component parts of tears appear to be water, mucilage, soda, muriate of soda, phosphate of lime, and phosphate of soda.

The mucus of the nose is composed of the same ingredients as the tears; but being more exposed to the air, the mucilaginous part absorbs oxygen, and thus gives it a greater degree of viscidity.

III. *Solid parts of Animals.*

The solid parts of animals are the bones, skin, muscles, cartilage, brain, and nerves, and hair, and nails.

1. *Bones.*

The bones, which are those parts of animals which give firmness and strength to the body, are different in solidity and density, of a white colour, lamellated structure, and inflexible. When bone is burnt, it is converted into a white porous insipid substance which still retains the original form; when it is boiled in water, an oily matter is separated, and when the boiling is continued longer, a portion of gelatine appears.

If bone be kept some time in diluted muriatic acid it becomes flexible, although it still retains its form; when dried becomes brittle and semi-transparent, is soluble in nitric acid, and when the acid is diluted is converted by its action into gelatine, and with the fixed alkalies it forms a soap. In these properties, it resembles coagulated albumen, and this substance, which is called cartilage, is the first part of the bone.

The component parts of bones are fat, or an oily matter, gelatine, cartilage, phosphate of lime in large proportion, a small portion of carbonate of lime, and a smaller proportion of sulphate of lime.

2. *Skin.*

The skin is the external covering of animals, and is composed of the epidermis or cuticle, the true skin, and a soft intermediate substance called *rete mucosum*. The epidermis separates from the true skin by maceration in hot water; it is a thin, elastic substance, insoluble in water and in alcohol; is immediately changed to a yellow colour by nitric acid, and at last entirely decomposed, and is soluble in caustic fixed alkalies. These properties indicate the epidermis to be coagulated albumen, peculiarly modified.

The true skin is denser and thicker, contracts when first heated, then swells up, and exhales a fetid odour, and leaves behind a thick mass of charcoal; it is softened by weak acids; becomes transparent, and is at last dissolved; is converted into oxalic acid and fat by means of nitric acid, and into oil and ammonia by the action of the concentrated alkalies. By boiling in water, skin is entirely dissolved, and is converted into glue; it combines readily with tan, and the compound thus formed is leather.

The *rete mucosum*, or mucous substance, lies between the epidermis and the true skin; it is this substance which, being of a black colour, occasions the peculiar complexion of the negro-race; and it is a curious fact, that, even in the living body, it may be deprived of its colour by means of oxymuriatic acid. The foot of a negro, which was kept for some time in water, impregnated with that acid, became nearly white, although the black colour was restored in a few days.

3. *Muscles.*

The muscular or fleshy part of animals is of a reddish white colour, and fibrous structure. If a portion of muscular substance be separated into small pieces, and washed with cold water, it becomes white; the water coagulates with heat, and albumen and a portion of *fibrina* are obtained. By boiling the same muscular matter for some time in water, another portion of albumen is obtained; and if the water be evaporated it is converted into jelly, which being treated with alcohol, after evaporating to dryness, the extractive matter is taken up, and the gelatine and phosphoric salts remain undissolved. What remains of the muscular substance is of a grey colour, is insoluble in water, and when dried becomes brittle. This matter is fibrina, which constitutes the larger portion of muscle.

If a portion of muscle be dissolved in nitric acid, a precipitate of phosphate of lime is formed by the addition of ammonia. This effect is not produced on muscle which has been long boiled in water; but carbonate of lime remains after boiling the muscular substance, and, by the action of nitric acid, is converted into oxalate of lime.

The constituent parts of muscular matter are fibrina, albumen, gelatine, extractive matter, phosphate of soda, of ammonia, and of lime, and carbonate of lime.

The difference of solubility of the constituent parts of muscle, and the different effects of heat on these matters, render the sensible qualities very different, according to the manner in which it is prepared for food. By boiling the flesh of animals, the soluble parts, as the gelatine, the extractive matter, and part of the saline bodies are dissolved, and to them the nutritious quality of soups is to be ascribed; but, by roasting the flesh of animals, it acquires a much higher flavour, because those substances, and particularly the extractive matter which gives the odour and flavour are not separated. The brown crust formed during the roasting of flesh is supposed to consist of this extractive matter.

The muscular parts of animals being exposed for a considerable time to the action of running water, are converted into a peculiar matter, which in some degree resembles spermaceti. A similar change was observed in the year 1786 to have taken place on the other soft parts of human bodies, great numbers of which had been thrown together into the same pit in the Innocent's burying-ground at Paris. It was supposed that a period of 30 years is necessary in such circumstances, to effect this conversion; but, by the action of running water, it may be completed in a much shorter time.

The substance thus formed is white, soft, and unctuous to the touch, melts like tallow, is decomposed by diluted acids, and, by the action of alkalies and lime, ammonia is evolved. It loses its white colour by exposure to the air, the ammonia is almost entirely dissipated, and a waxy matter remains behind. The oily matter, which is separated by diluted acids, is of a white colour and concrete; changes, by drying, into brown, and assumes a crystalline lamellated texture, like spermaceti; melts at 126°, and is soluble in alcohol, at the temperature of 120°; forms a soap with alkalies, and burns like oil; but the disagreeable odour which it exhales during combustion, is a serious objection against its use.

4. *Membranes, Tendons, and Ligaments.*

Membranes are those parts of the body which envelope and protect the internal parts of animals; they possess different degrees of transparency, and some of them are extremely thin. They are reduced to a pulp by maceration in water, and are almost entirely converted to gelatine by boiling, so that they consist chiefly of that substance.

The constituent parts of tendons seem to be the same with those of membranes, for they are reduced by boiling to a gelatinous mass.

Ligaments, by boiling in water, also yield a portion of gelatine; but as they are not like tendons and membranes entirely reduced to jelly, it appears that some other substance beside gelatine is one of their constituent parts.

5. *Brain and Nerves.*

The matter of the brain and nerves is distinguished by a soft soapy feel, a close texture, and a greater specific gravity than that of water. Exposed to the air when the temperature is at 60°, it soon becomes putrid, and exhales a very offensive smell, with a copious evolution of ammonia; it is not soluble in cold water, but, by trituration with water in a mortar, a part is dissolved, and this solution coagulates with a moderate heat. The addition of sulphuric acid to the solution, separates white flakes from it which swim on the surface, and the liquid assumes a red colour; a similar effect is produced by nitric acid, but the colour of the liquid is yellow. By adding nitric acid till the solution acquires a slight degree of acidity, a white coagulum separates, which is insoluble in water and alcohol, becomes soft when heated, and transparent when dried. These properties correspond with the character of albumen.

By treating brain with diluted sulphuric acid, the phosphates of lime, soda, and ammonia, with some traces of sulphate of lime make their appearance in small proportion, and when it is treated with diluted nitric acid, the acid is decomposed, a great deal of ammonia is evolved, and a bulky mass of charcoal, mixed with oxalic acid, remains behind.

Brain is soluble in concentrated caustic potash, and a very copious evolution of ammonia takes place during the solution.

6. *Hair and Nails.*

Including under the general name of hair, bristle, wool, down, and feathers, which are the coverings of different animals, and which appear to possess analogous chemical properties, it will be found that these substances vary greatly in size, length, and colour in different animals, and even in different parts of the same animal.

When hair is subjected to the action of water above the ordinary boiling temperature, by being confined in a Papin's Digester, it is dissolved, and a bituminous oil, which is slowly deposited, makes its appearance. As black hair yields a black oil, and red hair a reddish yellow oil, it is inferred that the colour of the hair is to be ascribed to this oil. The oil being separated by filtration, the liquid, which is nearly colourless, affords an abundant precipitate with the infusion of nut-galls and oxymuriatic acid, blackens silver, and gives a brown precipitate with acetate of lead; it becomes turbid by the action of the acids, and with another portion of acid the precipitate is redissolved. No jelly is obtained by the concentration of the liquid.

A very weak solution of potash dissolves hair and hydro-sulphuret of ammonia is given out during the solution. If black hair be employed, a dark coloured oil, with a portion of sulphur and iron, and if red-hair be dissolved, a yellow-oil, with some sulphur and iron, remains undissolved. Acids precipitate a white matter in this solution, and this matter is again dissolved by an excess of acid. Sulphuric and muriatic acids, when first added to hair, assume a red colour, and gradually dissolve it. Nitric acid also dissolves it, renders the hair yellow, and as the hair is red or black, separates a red or black oil.

By digesting alcohol on black-hair, two kinds of oil are separated, one of which is white, and is in the form of white shining scales, when the solution cools; and the other, which is of a greyish-green colour, becomes solid by evaporating the liquid. When red hair is treated with alcohol in the same way, two oils are also separated, one of which is white and the other a deep red.

By reducing hair to ashes, phosphate, sulphate, and carbonate of lime, muriate of soda, and a large proportion of silica, with some iron and manganese, are obtained. The proportion of metallic substances is less in red-hair and least of all in white-hair, in place of which magnesia, which has not been detected in the other kinds, is found.

The nails, which are considered as an elongation of the epidermis, are attached to it, and separate when it is removed. By long maceration in water they are softened, and are readily dissolved by concentrated acids and alkalies, and may be stained with metallic oxides, and they combine with colouring matters. From the experiments which have been made on these substances, they appear to possess the properties of coagulated albumen, mixed with a small proportion of phosphate of lime.

The horns of animals possess nearly the same characters; the scales of serpents seem to approach nearly to the composition of horn; but the scales of fishes contain a large proportion of phosphate of lime, which is arranged in alternate layers with a membranous substance.

PART III. OF ARTS AND MANUFACTURES.

According to the arrangement proposed at the commencement of this Treatise, the application of the principles of chemistry to Arts and Manufactures, the processes of which depend on those principles, was assigned to the Third Part; but as these different arts and manufactures will be more fully detailed under their particular heads, in the order of the alphabet, the reader is referred to these treatises, such as Bleaching, Dyeing, Tanning, the manufactures of Soap, of Glass, and of Porcelain, &c.

Description of Plates.

Plate 39.—Fig. 1. and 2. is a section of the furnaces, and a general view of the laboratory of the Surrey Institution, London.

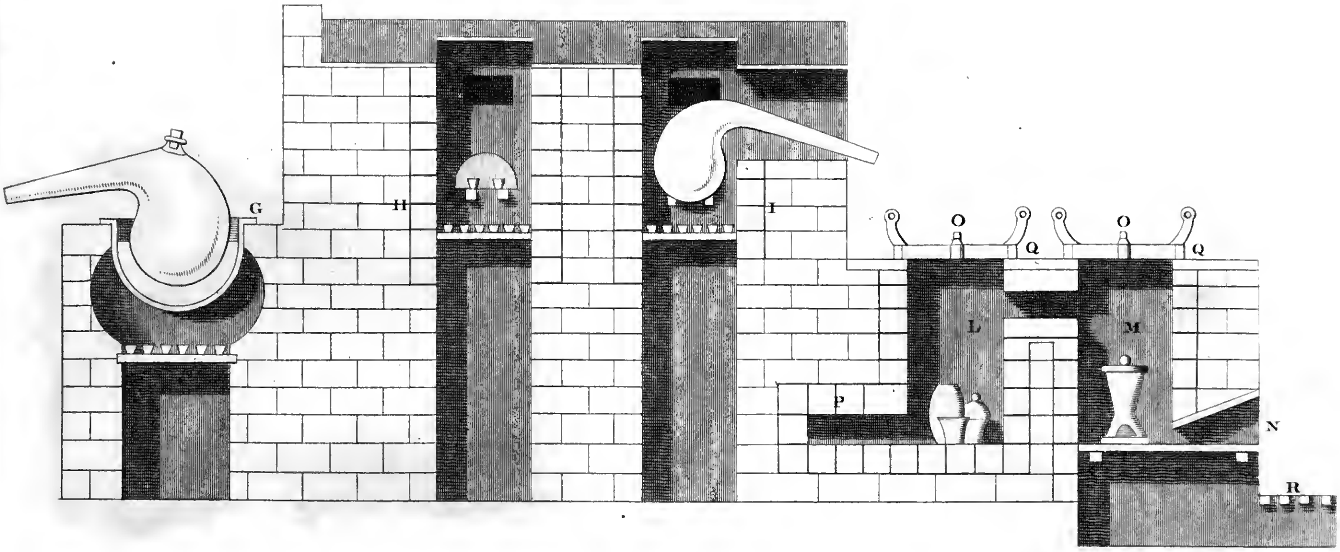
Fig. 1. G, is a furnace, which is fitted to receive an iron sand pot, on which is placed a retort of glass or earthen ware, as is seen in the section, and for the purpose of distillation. When any process requires a different apparatus to be substituted for the retort, as a copper still or an iron retort, the furnace may be so constructed as to admit of it. H is a muffle furnace for assaying metals by cupellation. The same kind of furnace answers for roasting metallic ores, for enamelling, and staining glass. I, is a furnace for distillation by the naked fire. The neck of the retort, as in the section, passes out at an opening in the side of the furnace; and this opening is closed up by luting during the operation. This furnace is extremely convenient for the distillation of quicksilver or of phosphorus, or for the preparation of oxygen gas from manganese. L is a reverberatory or annealing furnace, through which the flame of the furnace, M, passes in its course towards the chimney, P. The draught of the furnace M is greatly increased by this contrivance; and it is found useful for gradually heating crucibles, to enable them to bear a high temperature in M, which is a smelting or wind furnaee, for the reduction of metallic ores or other purposes, in which the highest degrees of heat are required. The interior of the furnace is seen with a crucible supported on a stand. N is an opening for clearing or removing the bars of the grate. Q Q are moveable covers for the furnaces L and M. These covers are constructed with fire-bricks neatly ground, and secured by a strong iron band; and earthen stoppers O O are fitted to openings in the centre, through which the progress of the operations may be seen. R is an extended ash-pit, which is covered with a moveable iron grate, and besides admitting a copious current of air, saves space in the laboratory. Each furnace has a distinct chimney.

Fig. 2. is a perspective view of the laboratory. B, B, B, is a shade or covering which extends over all the furnaces, for the purpose of receiving the vapours which arise during the processes, and carrying them off by means of the two air flues C C, which pass through the roof of the building, and terminate by ventilators. D is a leaden sink which ought to have a copious supply of water, and is furnished with a drain pipe for letting off the waste water. E is a square sand bath, which is heated by a fire place, the door and register of which are seen at e e. F F are two round openings which communicate with a concealed flue in the wall, and receive the iron pipes of moveable furnaces, and when they are not in use are closed with tin covers. G is the

Laboratory of the Surrey Institution London.

Fig. 1.

Section of the Furnaces.

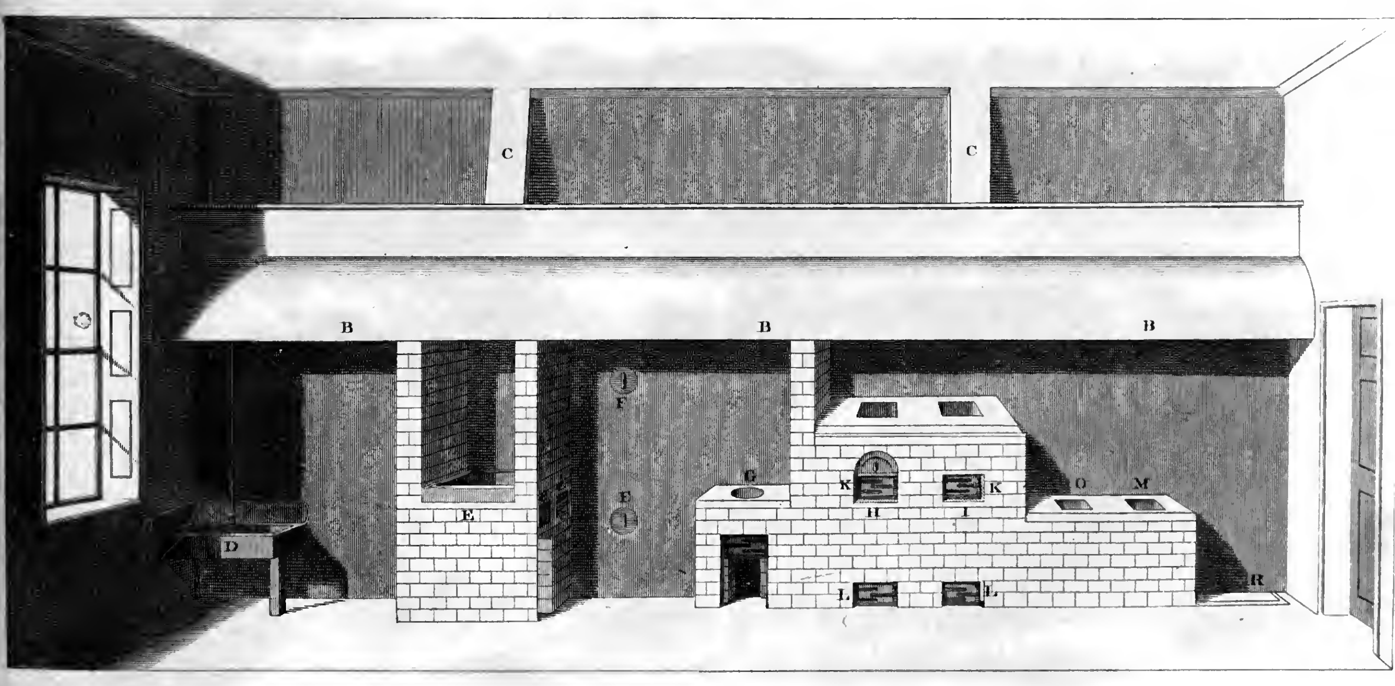


Scale of Feet.

0 1 2 3 4 5 6

Fig. 2.

Perspective View.



Scale of Feet.

0 1 2 3 4 5 6 7 8 9 10 11

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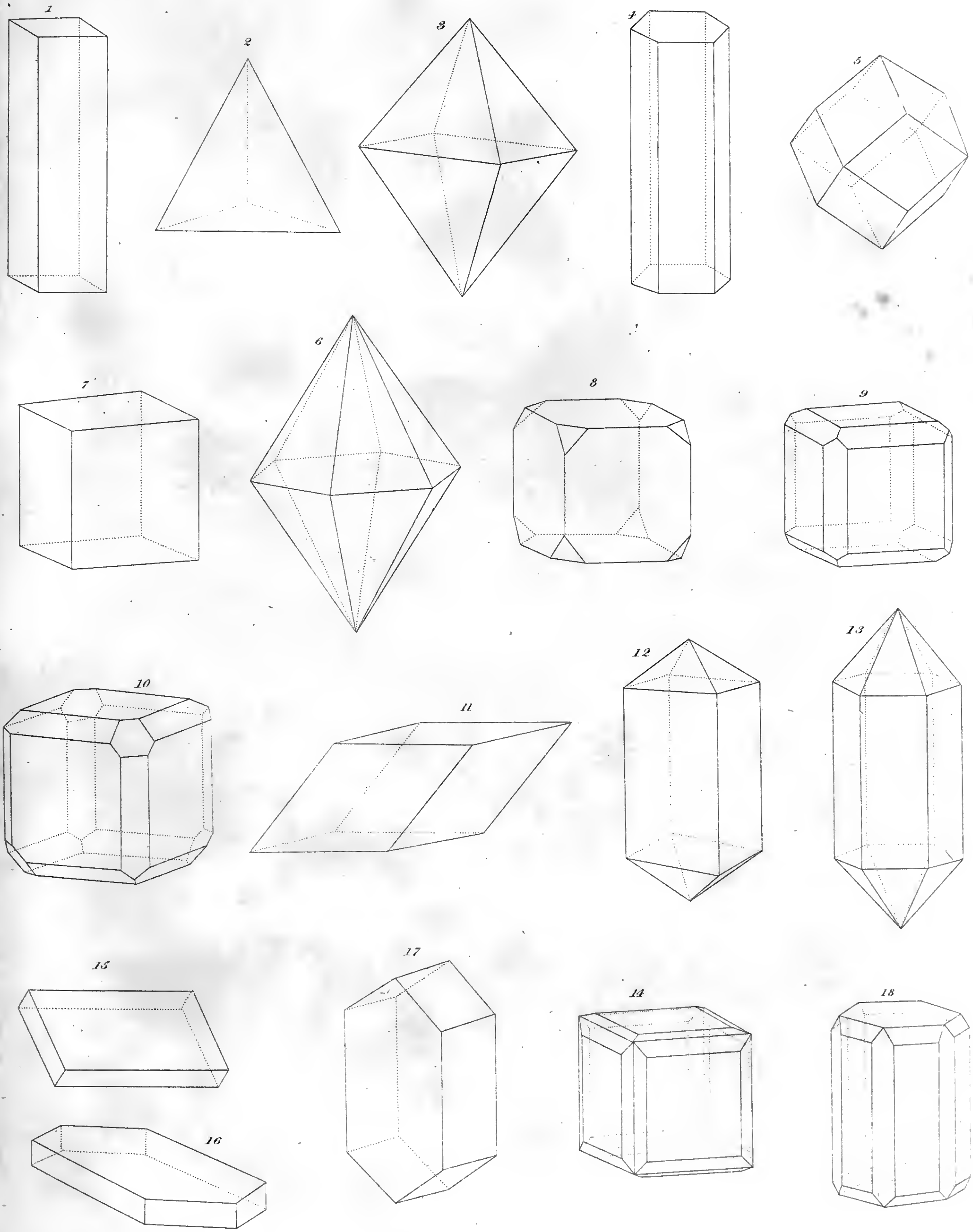
FORMS OF CRYSTALS.



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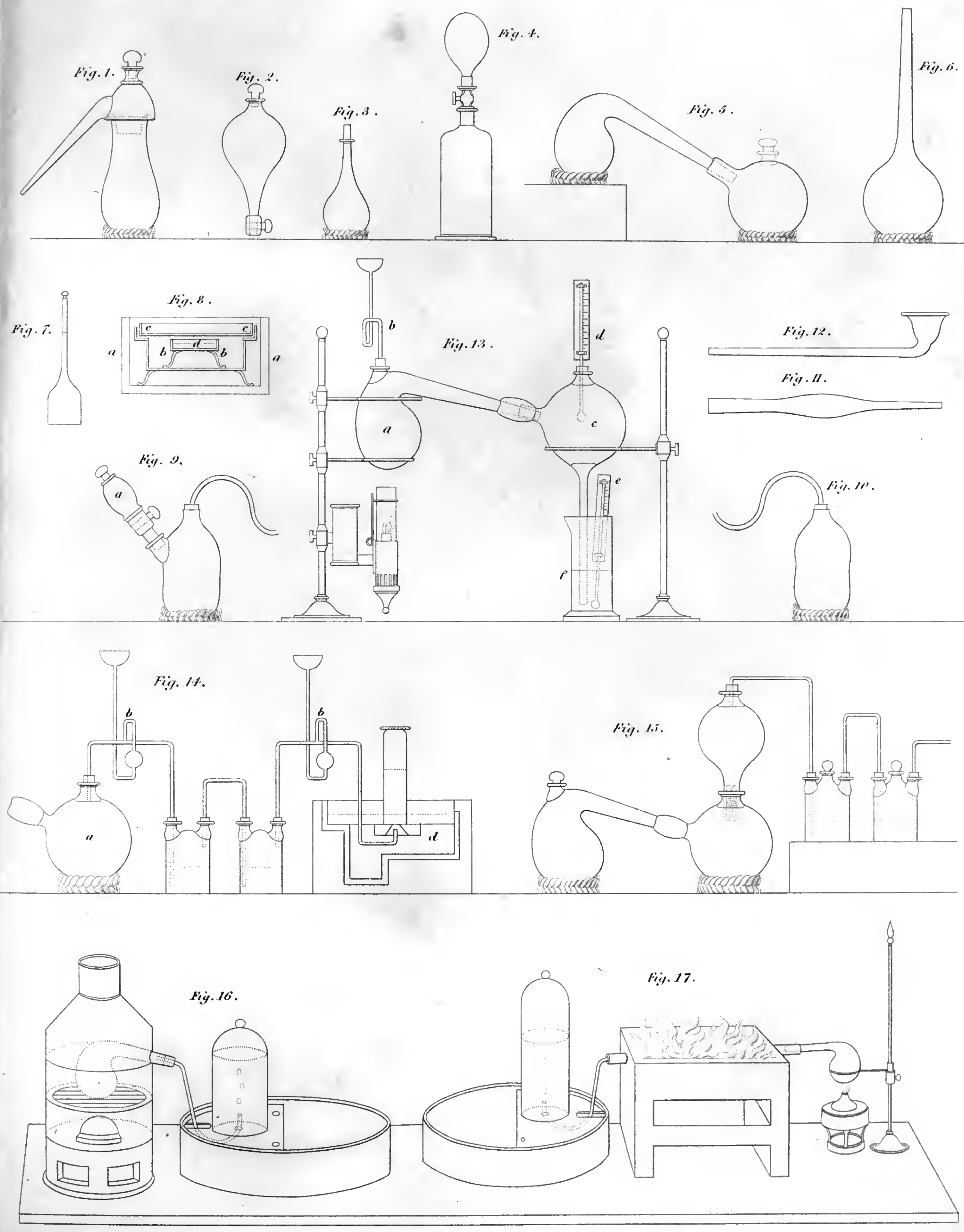

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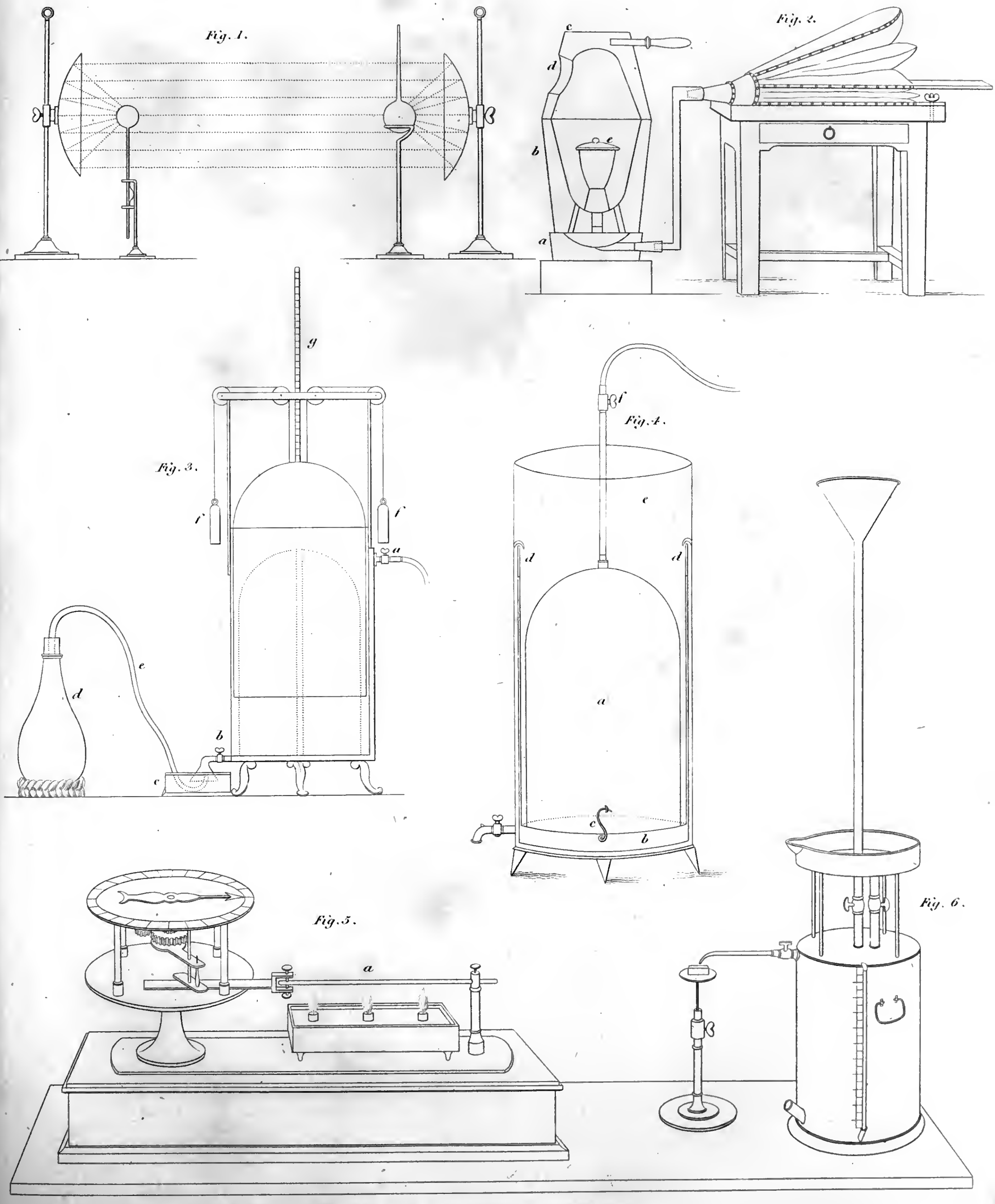
Fig. 1.
Fig. 2.
c
d
b
e
a
g
Fig. 3.
f
f
a
e
d
b
c
f
Fig. 4.
e
d
d
a
c
b
Fig. 5.
a
Fig. 6.

Plates.

furnace for containing an iron sand-pot, and corresponding with the furnace marked with the same letter in the section Fig. 1. H is the muffle furnace. I is the furnace for distillation with the open fire. K K are the doors of these two furnaces, which open on a level with the grates. L L are the doors of the ash-pits of the same furnaces. M is the smelting or wind furnace. O is the reverberatory or annealing furnace, and R is the extended ash-pit.

In the construction of a laboratory, the accommodations which the chemist can command, and the extent of the operations which he has in view, must, in most cases, regulate the plan which he adopts; but it may be observed, that different apartments are necessary for the different operations. The principal apartments should be on the ground floor, and being destined for both the fixed and moveable furnaces, the more spacious it is, it will undoubtedly be the more commodious; a table in the centre, the form of which recommended as the best, is that of a double cross, and shelves and drawers are the principal pieces of furniture required. For minuter operations, as in experiments with the gases, precipitation on a small scale, and all such processes as require only the heat of a lamp, another apartment of smaller size will answer; and a third apartment is necessary for preserving the nicer balances, and other delicate instruments, from corrosive vapours.

Plate 40. forms of crystals.—Fig. 1. A parallelopiped. Fig. 2. A tetrahedron. Fig. 3. Octahedron. Fig. 4. A regular six-sided prism. Fig. 5. Dodecahedron with equal rhombs. Fig. 6. Dodecahedron with triangular faces, composed of two six-sided pyramids united base to base. Fig. 7. The cube. Fig. 8. The cube having the angles truncated. Fig. 9. The cube having the edges truncated. Fig. 10. The cube with the angles and edges truncated. Fig. 11. Rhomboid. Fig. 12. The four-sided prism terminated by four-sided pyramids. Fig. 13. The six-sided prism terminated by six-sided pyramids. Fig. 14. The cube bevelled on the edges. Fig. 15. The four-sided table. Fig. 16. The six-sided table. Fig. 17. The four-sided prism terminated by dihedrons or two-sided summits. Fig. 18. The six-sided prism truncated on the angles and edges.

Plate 41.—Fig. 1. A glass alembic, consisting of a body and head accurately fitted to each other, to prevent the escape of vapours. The head is furnished with a projecting pipe, by which any liquids condensed on the head are carried off. Fig. 2. A vessel for separating liquids of different specific gravities, being furnished with a stop-cock at the bottom; when the different liquids have separated, according to their specific gravities, the stop-cock is opened, and the ground-stopper at the top being also removed, the heavier liquids flow out first. Fig. 3. A solution bottle, which may be suspended by means of a projecting ring at the neck, over a lamp, to apply heat. Fig. 4. A gas receiver of known capacity, which is furnished with a stop-cock and brass screw, to communicate with the lower vessel; the flask is weighed when exhausted of the air, and being again weighed when the gas is admitted, the additional weight acquired indicates the weight of a determinate quantity. Experiments of this kind should be made when the temperature and pressure of the air are the same, otherwise an allowance must be made for the difference. Fig. 5. A retort and receiver to the latter, of which a ground-stopper or a bent glass tube, where it is marked by the dotted lines, may be attached. Fig. 6. a matrass or glass vessel for the solution of bodies with the aid of heat. Fig. 7. A bottle for determining the specific gravity of liquids: It is made of such capacity as to hold a determinate quantity of distilled water, when filled to the mark on the neck; and the difference of weight between the same quantity of different liquids, indicates the specific gravity. Fig. 8. An apparatus for freezing quicksilver, by means of muriate of lime and snow. The outer vessel is of wood, about a foot square and seven inches deep, and furnished with a wooden cover. Within this vessel is placed a tin vessel, b b, standing on feet an inch and a half in height, and having a projection at the top, on which the shallow tin pan c c rests. A third vessel of untinned iron, supported by feet two inches high, is placed within the second vessel. This latter vessel is for receiving the mercury, and is four inches square. The mixture of muriate of lime and snow is put into the outer vessel a a, and must surround the middle vessel b b, into which the vessel d, with the quicksilver previously cooled down by another freezing mixture is introduced; the pan c c, is filled with the same materials, the wooden cover is put into its place, and the apparatus is left till the mercury is frozen. Fig. 9. A gas bottle, furnished with a bent tube, and with an acid holder, and from which the acid is admitted to act on the materials in the bottle by means of a stop-cock, and without permitting the escape of noxious or offensive vapours. Fig. 10. Is a gas bottle with bent tube only, which may be conveniently employed for preparing hydrogen gas. Fig. 11. An adopter, the wide end of which receives the neck of a retort, and the narrow end passes into the neck of a receiver. Fig. 12. A bent funnel for conveying liquids into a retort without soiling their necks. Fig. 13. An apparatus for shewing that caloric exists in gases in a latent form. If a gaseous substance be produced in the retort, in the tubulure of which the tube of safety b is inserted, and if the gas be admitted into the balloon c through the upper part of which the thermometer d is introduced, it will be found that the thermometer indicates but a small increase of temperature, while the thermometer, e, in the vessel of water, f, in which the gas is condensed, will rise to a considerable height. The application of heat when it is necessary, is made by means of an Argand lamp, which is placed below the retort. Fig. 14. Woulfe's apparatus for the preparation of elastic fluids that are condensed by water, or for impregnating water with such fluids, and at the same time to prevent their escape during the operation; a, is a balloon which receives the gas from a retort, and from which it passes through the bent tubes into the two bottles, from the last of which the bent tube terminates in the mercurial apparatus d, in the jar of which any gas that is not condensed by the water is collected; b b, are Welther's tubes of safety, which are convenient substitutes for three necked bottles, furnished with the common tubes of safety. These tubes

Plates.

of safety are intended to obviate the inconveniency that might arise from the sudden condensation of the gas in the apparatus. Fig. 15. Another form of Woulfe's apparatus, in which the balloon is surmounted by a vessel accurately fitted to it by grinding, and furnished with a glass valve, which allows the gas to escape upwards, but prevents the water in the upper vessel from passing downwards into the balloon. Fig. 16. Apparatus for the preparation of oxygen gas. An iron or coated porcelain retort is introduced into a furnace, with the manganese or other substance from which the gas is obtained, and being raised to a red heat, the gas is given off and conveyed by a tube luted to the beak of the retort, and terminating under a jar on the shelf of the pneumatic trough. Fig. 17. Apparatus for the decomposition of water. Water is boiled in the retort by the heat of a lamp placed under it, and the vapour being conveyed through the red hot porcelain tube passing through the furnace, and furnished with iron filings or pieces of iron, the oxygen combines with the iron, and the hydrogen passes off and is received in a jar placed on a shelf of the pneumatic trough.

Plate 42. Fig. 1. Apparatus consisting of two tin or brass reflectors for the purpose of shewing the reflection of caloric. An air thermometer is placed in the focus of the one, and a heated body, as a ball of iron two inches in diameter, or a matrass with hot water, in the focus of the other, or, if a piece of dry paper be substituted for the thermometer, it may be inflamed by the rays of heat passing from the red hot ball reflected and concentrated. Fig. 2. A portable brass furnace contrived by Mr Aikin, and composed of three parts made of the thin black lead melting pots which are used by the goldsmiths. The lower piece, a, is the bottom of one of these pots cut off so low as to leave only a cavity of about an inch, and ground smooth above and below. The middle piece, b, is a larger portion of a pot, with a cavity six inches deep, and measuring 7½ inches over the top, and perforated at the bottom with six blast holes. When it is necessary, a cover, c, of the same dimensions as the middle one, and opening at the side d, to allow the smoke and flame to escape, is fitted to it, and furnished with an iron stem, to which a wooden handle is attached for the convenience of removing it. The crucible, e, which is surrounded with fuel, of which coak answers best, and the heat is increased by means of the double bellows firmly fixed to a heavy stool. The air is admitted through a number of small openings in the bottom of the pot, and converging towards the crucible. Fig. 3. A convenient gas-holder or gasometer, in which one vessel is inverted over another within a large cylindrical vessel. Water is poured into the cylindrical vessel, and the inverted vessel is pressed down to the bottom. The stop-cock at a, being shut, and the stop-cock at b being opened, and a basin of water, c, being placed under it, the gas as it passes from the bottle, d, through the bent or flexible tube, e, is received into the gas-holder and forces it upwards. This part of the apparatus is balanced by the weights f f, and the quantity of gas within the vessel is indicated by the graduated stem g. When the gas is to be removed from the gas-holder into another vessel, the stop-cock at, a, is opened, while the other at b is shut, and it is forced out by pressing downwards the inverted vessel. Fig. 4. Is also a convenient gas-holder; a, is the vessel for containing the gas inverted in the shallow vessel b, and retained in its place by wire-hooks, one of which is seen at c. To the shallow vessel, b, two strong wires, d d, are attached for introducing it into the cylindrical vessel e, and it is kept by two projecting pieces seen above d d. When the vessel a is to be filled with gas, it is either sunk in water, or being merely placed in a sufficient quantity of water, the air may be drawn out by the mouth, and the water will rise, and then the stop-cock at f is shut. It is then filled with gas in the pneumatic apparatus in the usual way, replaced in the shallow vessel b, and the whole introduced into the outer cylindrical vessel, this latter being filled with water, and the stop-cock at f being turned, the gas may be received into other vessels by means of a flexible tube. This gas-holder answers sufficiently well where there is a command of water, and is easily constructed. Fig. 5. An apparatus for shewing the expansion of solid bodies by means of heat. The rod, a, is fixed at one extremity, and being heated by the lamp placed under it, the other extremity being attached to machinery, the minutest degrees of expansion are shewn by the index at the top of the apparatus. Fig. 6. A gas-holder, from which a current of oxygen gas is expelled with great force, for the combustion of metallic substances, or for the fusion of refractory matters.

INDEX.

CHENOPODIUM, Goose-foot, or Wild Orach, a genus of plants belonging to the Pentandria class.

CHEPSTOW, a town of Monmouthshire, in England, stands near the mouth of the river Wye, has a considerable trade both coastways and foreign, and contains about 2600 inhabitants.

CHER, a department of France in the central region, comprehending part of the province of Berri, has its name from the river Cher which rises in Auvergne, and joins the Loire below Tours, and contains about 370 square leagues, and 220,000 inhabitants. Much of the country consists of heathy or unfruitful land, but certain districts in the vicinity of the rivers with which it is watered are tolerably fertile in grain. Some good pastures are to be met with in the middle districts.

Bourges, the capital of this department, is a large city, but does not contain a population equal to its extent, the number not much exceeding 15,000. It is well built, is an archiepiscopal see, and has an university founded by Lewis XI. who had his birth in this city; is about 125 miles south of Paris, and carries on some trade in linen and woollen goods, which are its chief manufactures.

Sancerre, situated near the Loire, about 110 miles south of Paris, contains nearly 3,000 inhabitants. It was formerly reckoned a strong place, but being taken from the Protestants after a long siege in 1573, its fortifications were demolished. Charlemagne is said to have founded this place, and to have peopled it with Saxons.

St Amand, near the Cher, upwards of 20 miles south of Bourges, contains above 5000 inhabitants.

Mehun, a little old town on the Yvre, about 10 miles north-west of Bourges, is remarkable for the remains of the castle in which Charles VII. starved himself, in the apprehension of being poisoned by his own son, afterwards Lewis XI.

Aubigny in the northern extremity of the department, is a manufacturing town, containing more than 2000 inhabitants, and is still a place of some strength.

Henrichement, a market town about half-way between Aubigny and Bourges, has a manufacture of glass.

Lignieres, a little walled town on the Arnon, upwards of 20 miles south-west of Bourges, has a collegiate church and a castle.

Vierzon, a small place seated on the Cher, 17 miles north-west of Bourges, contains an abbey and three convents, and is famous for its iron forges

CHERASCO, a town of Piedmont, in Italy, stands on a mountain near the confluence of the rivers Stura and Tanaro, is well built, contains some spacious streets and elegant churches, has about 11,000 inhabitants, and enjoys a considerable trade in grain, wines, and silk.

CHERBOURG, a sea-port town of France, at the bottom of a spacious bay in the department of the Channel. The harbour is capable of admitting six hundred vessels of large size. Manufactures of woollen and cotton stuffs, and of common and plate glass, have been established, and the trade in grain, fruit, flax, butter, and salted beef and pork, is considerable. The population is stated at 14,000.

CHERSO, an island in the gulph of Venice, and near the coast of Croatia, is about 150 Italian miles in circumference, enjoys an agreeable climate, and although the soil be rough and stoney, yet it is remarkable for its fertility, and is well watered by numerous streams. The chief productions are cattle, honey, wine, and oil. The principal town of the island is said to contain 4000 inhabitants, and the total population is stated at 11,000.

CHERSON, or Kerson, a town of the province of Chatharineanslaf, in the southern part of the Russian empire, stands on a rising ground on the banks of the river Dnieper, and was founded by the late empress in 1777. In the course of six or seven years it is said the population rose to 40,000, but 20 years afterwards was reduced to about 10,000. The arsenal, the fortress, cathedral, and admiralty house, are the principal public buildings; the commodities imported are fruits, wines, fish, and household furniture, and the exports are wood, hemp, flax, cordage, wool, wheat, flour, iron, soap, and tobacco; but the trade has been of late on the decline, in consequence of the rising prosperity of Odessa, which is preferred on account of its purer air and more wholesome climate.

This place is worthy of commemoration as being the spot where our indefatigable countryman, Howard, closed his philanthropic labours in the year 1790, and was buried in the desert, according to his own desire, at a short distance from Cherson. An obelisk, or pyramid of brick, without any inscription, marks his grave.

CHERTSEY, a town of Surrey, in England, with a population exceeding 3600, manufactures malt, thread, and bricks, which are conveyed to London by the river Thames, and is memorable as the place where the Romans under Julius Cæsar crossed the Thames, and as the spot where the celebrated poet Cowley terminated his mortal career.

CHESAPEAK, a spacious bay in North America, 12 miles wide at its entrance, between Cape Charles and Cape Henry, and extending more than 200 miles to the northward, where it divides Virginia from Maryland, and receives the waters of several large and navigable rivers.

CHESELDEN, William, an anatomist and surgeon of considerable reputation, was a native of Leicestershire, and settled in London to pursue his profession. In 1713 he published his *Anatomy of the Human Body*, in a single octavo volume, and in 1723 a *Treatise on the High Operation for the Stone*; and by his success in that operation he rose to great eminence. On this account he is spoken of in the most flattering terms by Pope, in a letter to one of his friends, and seems to have been on very intimate terms with that poet. He died at Bath in 1752.

CHESHIRE, one of the western counties of England, is bounded on the north by Lancashire, on the east by the counties of Derby and Stafford, on the south by those of Salop and Flint, and on the west by the river Dee and the Irish channel. Two narrow necks of lands jut out like horns from its northern side, one of which branches off to the east at Stockport, and insinuates itself, for 15 miles in length and four in breadth, between the counties of York and Derby; the other, denominated the Wirral, is about 20 miles in length and 6 in breadth, and is interposed between the estuaries of the Dee and the Mersey. The length between the extreme points of these horns is fully 60 miles. The main area of the county, however, is only 40 miles by 30, forming an oval which measures 1017 square miles.

Surface and soil.—Cheshire is hilly throughout the whole extent of its eastern border, being on that side partially penetrated by the high ranges which traverse the counties of Derby and Stafford. The rocks of this elevated surface are composed of sandstone and limestone. A range of hills stretches also quite across the county towards the south, from the town of Frodsham to that of Malpas; this tract is some miles in breadth, and includes Delamere-forest, a bleak and dreary waste, well adapted however for the purposes of the chase; Beeston hill, surmounted by the ruins of a castle, which figures in the civil wars; and the Peckforton-hills, which extend to the southern frontier of the county. The whole of this range consists chiefly of sandstone rocks, and of deep beds of sand. Besides these hills, some points of which shoot up to a respectable height, and command extensive views, the peninsula of the Wirral rises to a considerable elevation. The summit of the ridge is much nearer the Mersey than the Dee, is surmounted, at the end which faces the sea, by a magnificent light-house, by many windmills throughout its whole length, and opposite to Liverpool by a forest of signal posts, which greatly enliven the prospect across the river. The rest of the county expands into wide plains, of a deep clayey soil, in a high state of cultivation.

Rivers and canals.—Many respectable streams flow from the amphitheatre of mountains, which encircle this county on the east and the south. Of these, the Mersey deserves the first notice. It is formed by a labyrinth of brooks issuing from the ravines of Derbyshire, and thence it flows along the northern frontier of Cheshire to the Irish channel, which it joins a few miles below Liverpool. In its course, this river receives many tributary streams from both its banks; the Gayte, the Tame, the Bollin, the Weever, and others of less note flow into it from the Cheshire side; and after it is joined by the Irwell from Lancashire, and by the Weever from the opposite bank, it swells out into a wide estuary covered with shipping of every description. The Weever derives its source from Ridley-pool, situated in the hilly ground which traverses the county; it passes several towns and gentlemens seats; drains that part of the county through which it flows on both sides; and by means of locks and wears, it has been rendered navigable for more than 20 miles above its mouth. About 120 vessels, from 20 to 100 tons burden, are constantly employed in carrying coals up, and salt down this river. The Dane flows from the northern part of Staffordshire, and unites with the Weever at Northwich. The Dee has its source in the mountains of Merionethshire; it flows from two spring heads, the united streams of which run through the Pemble-moor, without mixing, as is supposed, with the waters of that lake; it then shapes its course through Denbighshire; afterwards turns to the north, half encircles the walls of the city of Chester, and flows, partly through an artificial channel, into the sea.

But besides the streams which traverse the county, it is also intersected in different directions by canals. Of these, the Duke of Bridgewater's is the most magnificent, as well as the most ancient; at Runcom this canal joins the Mersey, to which it descends by a series of noble locks; it thence extends through the county for more than 20 miles, in a line nearly parallel with the Mersey. It is joined at Preston-creek by the *Grand trunk-canal*; which in its course across the county passes through a tunnel 1241 yards long, 17 feet 4 inches high, and 13 feet 6 inches wide. The Ellesmere canal, too, is carried across the Dee in an aqueduct of seven arches; is cut through the peninsula of the Wirral; joins the Mersey almost opposite Liverpool, and affords a short and a commodious conveyance between that town and the city of Chester. All these canals communicate with other parts of the kingdom, but that which is denominated the Chester canal is confined to the county whence it takes its name; it begins at the Dee, and terminates at Nantwich, passing in its course Christleton, and some other villages.

Minerals.—Coals are found in the north-eastern part of the county, and also in the peninsula of Wirral; building-stones and lime are quarried from the hills; small quantities of lead, cobalt, and copper ores, have been found at Alderley-edge in the vicinity of Macclesfield; and traces of the last mentioned ore have also been observed in the Peckforton hills. But the most valuable of the mineral productions of this county is its salt, which occurs abundantly, in the state both of rock and brine. This mineral, which is diffused through the eastern plain of the county, has, from time immemorial, formed an important article of commerce. The local situation of the principal pits are Nantwich, Middlewich, and Northwich, the last of which is now the chief seat of trade. At this place, the salt is derived both from the native rock and from brine springs. The rock salt is found from 28 to 48 yards under the surface of the earth, the first stratum of which is about 17 yards thick, of a brown colour, and extremely hard. The second stratum is from five to six yards thick, generally white and clear as crystal. But between these strata of salt, one of stones, about 30 yards in thickness, is interposed. Besides the salt obtained from the native rock by means of pits, sunk at much expence and with great hazard, a great deal is also obtained from the salt springs. They are from 20 to 40 yards deep; the brine is raised by means of a steam-engine, and conveyed through long troughs to the brine pits. This brine is boiled in iron pans, the scum taken off as it rises; the steam is made to rise as quickly as possible, and the salt purified and crystallized is collected once every 24 hours.

Agriculture.—The soil of Cheshire is in general fertile, and is under careful culture. The farms vary in size from a few to 500 acres, but the greater number is from 100 to 300. Some of the leases are for the period of several lives, and more of them for a specified number of years. Those farms which are of sufficient extent, are distributed into portions, for grain and green crops in regular rotation; and meadow and pasture, which are seldom encroached on by the plough. Many of the fences, (as throughout the whole of Lancashire and other parts of England,) are embankments of earth surmounted by a straggling copse, which, if they warm, they also waste the land, and harbour vermin. The hedge-row trees which also abound in this county, though they improve the prospect are no more friendly to the husbandman than the broad bottomed earthen mounds that incumber the ground. Wheat and oats are the principal grain crops, the former of which is sown both after green crops and summer-fallow. About an eighth part of most farms is kept constantly in meadow, the hay of which is in more estimation than that raised from sown grasses; a still larger portion is appropriated to pasture, the dairy being the chief object of the Cheshire farmer's attention. The method of making the cheese, for which this country is so deservedly celebrated, does not differ materially from what is followed in other places. The warm morning's milk is incorporated with that of the preceding evening previously skimmed, when it is put into a tub and well mixed with the cream, rennet, and colouring matter, and left an hour and a half to coagulate. The mass is then broken, the whey expelled, the curd put into the cheese-mould and placed in the press; here the cheese remains two or three days, during which time it is taken out of the mould several times, the cloths changed, and the edges pared off. It is next carried to the salting tub, afterwards placed on a bench where it is left for eight days, during which it is frequently turned. The last operation of the process is to wash it in warm water, to dry it thoroughly with a cloth, to smear it over with whey butter, and to place it for a while in the warmest place of the cheese-room, where it is left to harden, till carried to market. The Cheshire cows are neither large nor beautiful, nor do their pastures appear peculiarly rich, yet, on an average, each is said to yield about eight quarts of milk daily, and upwards of 300 lbs. of cheese in the course of the year.

Towns.—Cheshire contains a city and 13 market towns. *Chester,* the capital, is also a kind of northern metropolis, many families of the neighbouring counties making it the place of their occasional residence. This city, which, as its name indicates, was once a Roman station, is built on a rocky eminence, the foot of which is washed by the waters of the river Dee. The walls are entire, and more than a mile and three quarters in circumference; and have an excellent walk on their top, from which at every point of the circuit are extensive prospects of distant mountains and a cultivated country. The principal streets diverge from a common centre, in the line of the cardinal points, towards four gates which open to the country through the walls. These streets, to the depth of a story, have been excavated from the solid rock, a circumstance which has given the houses on each side of them a singular appearance. The first floor is occupied with shops and cellars, the doors of which are as low as the streets; the second is on a level with the surface of the ground on which the city stands, and is balustraded in front perpendicular with that of the story below; within the balustrade a gallery extends the whole length of the streets; and within the galleries are ranges of ill-lighted, but well furnished shops. The galleries are denominated rows, and form a fashionable promenade. The public buildings of Chester are its churches, which, with the cathedral, are eight in number. The cathedral is a large venerable pile, but its external appearance is rather ragged, arising from the decomposition of the stones of which it is constructed. St Oswald's church is connected with the cathedral; St John's is in the suburbs, and is very ancient. The castle stands on the south east side of the city, and consists of two wards, within which is Lupus-hall, a room 99 feet by 45, and high in proportion. Much of the old building has been removed to make room for the county goal, which is on a magnificent plan. The bridge of 12 arches, which at this city leads across the Dee, must not be passed without notice. The *Pentice* is an ancient building near the centre of the city, supposed to occupy the site of the Roman prætorium. The justice-of-peace courts are held within this structure. The exchange is a large building, in which are most of the public offices of the city. The infirmary stands in an airy situation fronting the west; besides this, there are several other charitable institutions in the city, such as the house of industry, the blue coat hospital, several alms-houses, and charity and Sunday schools. The population of the city with its suburbs approaches to 20,000 souls, many of whom are people of fortune, who afford employment to many of those of inferior rank. The rest find occupation in iron founderies, ship-building, glove, tobacco-pipe, snuff-box, white and red lead, and shot manufactures. The majority of the inhabitants adhere to the established church; but the Presbyterians, the Independents, the Quakers, the Catholics, the Methodists, and the Swedenborgians are also numerous, and some of these sectaries have elegant places of worship. Chester is governed by a mayor, a recorder, two sheriffs, 24 aldermen, 40 common council-men, and sends two members to Parliament. It has a market on Saturday, plentifully supplied with all kinds of provision; and three fairs in the year for cattle, Irish linen, cloths, hardware, hops, drapery, and Manchester goods. This city is 190 miles distant from London.

Stockport is built on a rocky and irregular surface on the banks of the Mersey, six miles from Manchester, on the London road. Its ancient parish church and spacious market place occupy the highest station of this uneven site, from which streets (some of them extremely steep) diverge in all directions. It contains two churches, St Mary's and St Peter's, several chapels, many dissenting meeting-houses, and a magnificent Sunday school. The police of the town is under the direction of two magistrates, two constables, four church-wardens, and three overseers. Although Stockport traces its origin to remote antiquity, the Romans having had a castrum and the Saxons a fortress on its site, yet it owes its numerous inhabitants, and its thriving condition, to its cotton, silk, and hat manufactures. Above and below the town, and on both banks of the river Mersey, are many silk and cotton mills driven both by water and steam, and which give employment to a large proportion of its 15000 inhabitants. It has a market on Friday, at which great quantities of corn, oatmeal, and cheese are sold, and three fairs for cattle.

Macclesfield is situated on a steep declivity, at the foot of which the river Bollen has its course. Its main street is a mile and a half in length, and is built along the high road from Stockport to Leek. Both its churches, the old one founded by Edward I. in 1279, and the new one erected in 1775, are regarded merely as chapels of ease under the parish of Prestbury. The corporation consists of 24 aldermen, four of whom are in the commission of the peace, and one is a mayor and justice of the quorum. The mayor is always lord of the manor, the revenues of which are about L.200 per annum, arising from tolls and money paid for water conveyed to the town from the common in pipes; he also possesses the right of nominating the minister of the parochial church. Macclesfield has about 15,000 inhabitants, who find employment in the different branches of the silk and cotton trade, in the making of buttons of silk, mohair, and twist, in the collieries situated on the common, and in the smelting works for preparing brass and copper. The charitable institutions of this town are, a grammar school, endowed by Edward VI. and a Sunday school in imitation of that at Stockport, supported by the dissenters.

Nantwich stands in a luxuriant vale on the banks of the Weever, and is disposed into two streets of old irregularly built houses. Its church is constructed in the form of a cross, and has beautifully ornamented windows. It has about 4000 inhabitants, governed by constables, who are chosen at the court leet of the lord. The manufactures of the town are salt and cotton; gloves and shoes are made in great quantities; the tanning of leather, which was formerly the staple trade, is now on the decline. The Chester canal terminates here in a broad bason, but has not hitherto increased the salt trade. This was the only town in the county, which, during the civil wars, adhered steadily to the parliament. The widow of the poet Milton spent here the latter years of her life, and died at a very advanced age in 1726. The market is on Saturday.

Middlewich is a small town, with a population of about 1200, situated near the confluence of the Dane and the Weelock, on the banks of the Trunk-canal. The town consists of three streets, disposed in the form of a triangle. The church is large, and the vicarage extends over several townships. Salt is the staple trade, and cotton-spinning has lately been introduced. The market is on Thursday.

Northwich is built on the banks of the Weever, near the place where it is joined by the Dane. The streets of this town are irregular, and the houses but of indifferent architecture; yet being the center of the salt-trade, and having many dairy-farms and gentlemens' seats in its vicinity, much business is transacted in its market, which is held on Friday. The population amounts to 1400. Its large church is remarkable for the circular form of its choir. The road between Manchester and Chester passes through this town.

Knutsford is pleasantly situated on a stream, which divides it into what is called High and Low Knutsford. It is well built, has a modern church, with an excellent organ, and about 2400 inhabitants. Its manufactures are cotton, silk, shag-velvets, and sewing-thread. Its horse-races attract much company; it has several fairs in the course of the year, and a market on Saturday.

Sandback is built on an elevated situation. It consists of one street along the high-road between Newcastle-under-Line and Middlewich, and two smaller ones diverging from each side. The houses are mostly ancient, irregular, and in a state of decay. It has near 2000 inhabitants, and was once famed for the excellence of its ale, worsted, yarn, and stuffs; but its trade has latterly been on the decline. It has two fairs in the year for cattle and horses, and a market on Thursday.

Congleton, a small, neat, incorporate town, situated on the upper part of the river Dane, near the borders of Staffordshire. It contains about 4000 inhabitants, employed in the manufacture of tagged leather laces, called Congleton points, ribbons for the Coventry merchants, gloves, and purses. It has several fairs in the course of the year, and a market on Saturday.

Frodsham is situated not far from the junction of the Weever with the Mersey, at the northern extremity of the Delamere forest. The church stands on a place called Overton, which is elevated far above the town. Near the church is a school, with a good house for the master, and a cupola on its summit for an observatory. The brow of an eminence, called Beacon-hill, behind the school, is cut into a pleasant walk, which comprehends a view of the estuary of the Dee, and the distant parts of Lancashire. The burial-register of this town records two remarkable instances of longevity,—Thomas Hough, aged 141, and Randal Wall 103,—the one buried the 13th and the other the 14th of March 1592. This town enjoys its share of the salt and cotton trade. Vast quantities of potatoes are cultivated in the parish, not less than 100,000 bushels annually, which find a ready sale in the great towns of Manchester and Liverpool. Fairs in May and August, and market on Wednesday.

Malpas is situated in on elevated spot near the south-end of the Peckforton hills, and consists of three paved streets. Its church is large and handsome; its revenues support two rectors and two curates. This town has a free grammar-school, and an alms-house. The market is on Monday.

Runcorn is a small but pleasant village on the Mersey, about 20 miles above Liverpool, with which it maintains a constant intercourse by means of its packets. The Duke of Bridgewater's canal here descends to the river by a series of well constructed locks, near which are large wharfs and warehouses. Runcorn has schools for young ladies, and is a well-frequented watering-place.

Altringham stands on the banks of the Duke of Bridgewater's canal, disposed in two parallel streets, intersected by two others of smaller size. This town is well built, and has a handsome appearance. Its government is vested in a mayor and common-council. It has neither church nor chapel, the inhabitants (1700 in number,) frequenting the neighbouring church of Bowden. Since the introduction of the cotton-manufacture, that of worsted, which formerly prevailed, has greatly declined. The market is on Tuesday.

Parkgate is built in a straggling manner along the Cheshire bank of the Dee. It is a station for the Irish packet, and has of late been much frequented for bathing. Its inhabitants amount to about 1500.

Torporley consists of a single well built street, on a hilly situation, about two miles distant from the far-famed Beeston-castle. This little town is remarkable chiefly for its annual hunt, for which the extensive heaths of the neighbouring country are so well adapted. It contains about 700 inhabitants, and has a market on Thursday.

Westen is a retired but beautiful village, nearly opposite the junction of the Weever and the Mersey. Its vicinity is enriched by some of the most luxuriant scenery in the county, though its secluded situation, at a distance from the course of the public roads, has hitherto been the means of concealing its beauties from the public view.

Population of the county.—These towns, with numerous villages, are distributed among the seven hundreds, Bucklow, Broxton, Eddisburgh, Macclesfield, Nantwich, Northwich, and Wirral, into which the county is divided; and these hundreds are again subdivided into 68 parishes, which contained, in 1811, 41,187 houses, and 227,031 inhabitants. The manufactures peculiar to the different towns of the county have long been on the decline, and some of them are now nearly extinct. It would seem that the silk, and especially the cotton trade, will triumph over them, and pervade the whole of Cheshire, as it has already pervaded Lancashire. The salt and the cheese of the county are the principal articles of exportation. Of the former above 60,000 tons are delivered from the pits annually, refined, at Northwich, Frodsham, the Dungeon-works, &c. About 50,000 tons of this salt are conveyed to Liverpool, and thence exported chiefly to the Baltic. The cheese is sent to London, to most of the provincial towns of England, to Ireland, and Scotland. Coal, lead, calamine, copper-plates, and cast-iron, are also exported from the city of Chester. The silk and cotton manufacturers of the county have generally warehouses in Manchester to which they convey their goods.

Ecclesiastical state.—The bishopric of Chester originally made part of that of the diocese of Litchfield. But on the suppression of the monasteries in the reign of Henry VIII. it was erected into a distinct see, comprehending the whole of Cheshire and Lancashire, part of the counties of Westmoreland, Cumberland, York, and Flint. The bishop is patron of the livings in the city of Chester, and several others in the bounds of the diocese, all of which is included in the province of Canterbury.

Historical notices.—This county still retains vestiges of its subjection to the Romans. Mr Whitaker has made it probable, that Kinderton, in the vicinity of Middlewich, agrees to their Condate. After that people had abandoned Britain, Cheshire continued in the possession of its original inhabitants till about the year 607, when it was conquered by Ethelfrith, the Saxon king of Bernicia. Subsequent to this event, it became a scene of contention between the petty provinces of the heptarchy. Alfred the Great divided it into seven hundreds; and Canute, the Dane, invested the Earls of Chester with its administration, three of whom enjoyed the honour previous to the conquest. After the conquest, Cheshire was bestowed, by the Norman king, on Hugh Lupus, a valiant Fleming, to whom he was indebted. For him the county was made palatine, with the privilege of holding its own parliaments and courts of law. In virtue of the royal prerogative which had been conferred upon him, he formed a parliament, and created barons, who, with their retainers, were bound to attend his court and to fight his battles. The sword of Lupus may still be seen in the British museum, inscribed *Hugo Comes Cestriæ.* The kind of government which Lupus had established continued till the time of Henry III. who took the earldom of Chester into his own hand, and bestowed it on Edward his eldest son; and since that period the heir-apparent of the crown of England has always had the title of the Earl of Chester, as well as Prince of Wales. During the reign of Henry VIII. the county-palatine of Chester was made subject to the crown of England, being permitted to retain a few only of its ancient privileges; such as, that all pleas of lands, tenements, and contracts, must be determined within the county; and that no native of it can be compelled to be tried out of it for any crime unless that of treason against the state. It returns four members to parliament, two for the county and two for the city; pays seven parts of the land-tax, and furnishes the militia with five hundred and sixty men.

A woman of the name of Mary Davis, a native of this county, is said to have been deformed by a very extraordinary peculiarity. She was born at Great Aughall, near Chester, in 1598. In her 28th year a wen grew on the right side of her head, a little above the ear, which, after thirty-two years, shot out into two horns, which continued five years, and then were shed. They were succeeded by several others, which grew and were cast like the first. She was exhibited in London when upwards of eighty years of age; several portraits were taken of her, one of which is in the British, and another (as also one of her horns) is in the Ashmolean museum.

CHESS, a very ancient and ingenious game, which is played on a board divided into 64 squares or houses; and in Europe with 16 pieces on each side, which have different names, characters, and powers, in the order of the game. See GAMES.

CHESTER, an ancient city, and capital of Cheshire in England. See CHESHIRE.

CHESTERFIELD, a town of Derbyshire in England, is a place of considerable antiquity, contains nearly 5000 inhabitants, and has manufactures of coarse earthen ware, shoes, and woollen stuffs.

CHESTER LE STREET, a village in the county of Durham, and supposed to be the *Condercum* of the Romans, consists chiefly of a single street, which is a mile long, and is remarkable for the spire of the church, which is 156 feet in height. The population of the whole parish, including some other villages, exceeds 1200.

CHICHESTER, the capital of the county of Sussex in England, was formerly strongly fortified, contains nearly 7000 inhabitants, who are engaged in the manufacture of coarse woollen stuffs, and in ship-building.

CHILI, an extensive region of New Spain, situated between the 24th and the 45th degrees of south latitude, and the 68th and 74th of west longitude; is bounded by the Pacific on the west, the Andes on the east, the province of Peru on the north, and by Terra Magellanica on the south.

General aspect.—Chili, at different points of view, presents to the traveller all the imposing awfulness of the sublime, all the soothing loveliness of the beautiful, and all the pleasing variety of the picturesque. If he ascend to the summit of the mountains, some of which are elevated to a great height above the surface of the sea, he will tread on the snows of a thousand years, or the ashes heaved from unfathomable depths; he will hear the howling of eternal tempests, and the roaring of unquenchable fires; and his eye will wander over a scene of wild and unbounded desolation. Having surveyed the far-extended fields of ice; beheld the terrific blazing of the volcano; looked down from the margin of a yawning crater, or a headlong precipice; and having contemplated the grandeur and felt the horrors of the scene, he will be eager to return to a safer and more sheltered situation. In his descent, he may mark the shape of the serrated ridges he has left, and the precipitous cliffs which characterise their front, deeply channelled with the unceasing and impetuous rushing of numberless torrents. He may mark how the streams which issue from the expansive lakes, from the dissolving snows, and from the filtered springs, meet and mingle in the valley, till swollen into noble rivers they traverse the plains in placid majesty. Among the recesses of the rocky mountains, and by the banks of the flowing waters, the delighted traveller will frequently find spots adorned and enriched with whatever is good for food and pleasant to the view. When he has passed the foot of the mountains, he may stand on the edge of a gently sloping plain extending before him far beyond the horizon, and survey the stately forests, the green pastures, the cultivated land, the exquisite gardens, and the well-built cities with which it is diversified and adorned. As he proceeds westward over these plains, his progress will be interrupted by a triple row of hills, extended parallel with the coast, as if intended to defend this delightful region from the inroads of the ocean. From the top of these barrier walls he will behold that expanse of water, emphatically called, on account of its unruffled smoothness, the Pacific ocean, the waving outline of the coast of Chili, and the groups of islands near its shore: And having thus, from the height of the mountains to the side of the ocean, crossed this diversified region, he will have obtained a correct general idea of its external scenery.

Mountains.—When it is said, that the stupendous ranges of the Andes bound the eastern border of this country, it is at the same time a sufficient intimation of the towering elevation to which many points of its surface are exalted; for the highest summit of the Andes towards the north is elevated more than 20,000 feet above the level of the Pacific ocean. Several branches strike off from the main range to the west; detached hills are scattered over the intermediate plains, and a chain of mountains of inferior elevation lines the coast. Descabezado, a lofty region among the Chilian mountains, expands into a table-land of six or eight miles square, in the middle of which is a very deep lake, supposed originally to have been the crater of a volcano. According to travellers, there are still no fewer than fourteen volcanoes in a state of perpetual activity in the Chilian Andes; of these Villarica is by far the most magnificent, and is subject to frequent and copious eruptions; that which happened in 1760 was thrown with an impulse so powerful as to burst the side of the mountain. This volcano may be seen at the distance of one hundred and fifty miles. It is well known that the materials which compose the Andes are chiefly primitive rocks; but the midland and the maritime mountains of Chili include also secondary rocks.

Metals.—The mountainous districts of Chili are rich in several kinds of metallic ores. Grains, and sometimes masses of gold, are found in the beds of the rivers; and productive mines are worked in several places. The usual matrix of the ore is a red, brittle, argillaceous stone, and the veins generally run from north to south. Silver ores, which are also abundant, but less widely diffused than the gold, are found chiefly in elevated situations. The mine of Aspalata, in the province of Aconcagua, is the richest of the whole, and is supposed to be a branch of the veins of Potosi. There are also in different parts of Chili mines of copper, mercury, and other metals; and, associated with the ores, or deposited in beds, great quantities of sulphur, pyrites, amber, and jet.

Rivers.—The streams and torrents which cross and divide the mountain declivities of Chili are very numerous. They all flow towards the west, and fall into the Pacific ocean at different parts of the coast by more than fifty mouths. Of these, the Biobio, the Valdivia, the Maule, the Tolten, the Cauten, the Coli, the S. Luis, the Rabudus, &c. deserve to be mentioned, on account of their magnitude or commercial importance. As they spring from their sources, these rivers flow with great rapidity; and being affected by all the changes which take place on the mountains whence they flow, they are subject to frequent and sudden swells.

Lakes.—Like other parts of the Spanish dominions in South America, Chili has many marshes and lakes, both salt and fresh. The lakes Bucalemu, Caguil, and Bojeruco, belong to the first class. Nahuelguapi, Redaguel, Aculeu, and Taguatagua, are fresh-water lakes, and some of them of great extent.

Soil.—The vegetable mould of a surface so highly elevated and so deeply depressed as Chili, must, of course, be extremely various. Large tracts of the mountain districts are deserts of unreclaimable barrenness; the maritime parts of the country are also comparatively sterile. But the intermediate plains, and still more the sheltered vales, are fertile in the highest degree, and are said to yield an increase from 60 to 300 fold. Deep beds of shells are found in many places of the coast, especially near Conception, from which great quantities of lime are extracted. But none of it, or of any manure, is laid upon the land, the soil every where possessing a richness and a warmth which ensure an inexhaustible fertility.

Climate.—The principal source of the fertility of this region is the very genial climate with which Chili is blessed. Among the highest mountains, indeed, winter reigns with unrelenting rigour throughout the year, and for several months the whole coast is darkened by a very dense fog which broods over it, except when the south wind blows, by which this foul and troublesome vapour is dispelled. The climate of the country in general is temperate, serene, and salubrious; the air is fanned by breezes from the Andes; and where the soil is not watered by gentle and frequent showers, the dews increase in copiousness. The winter, or rather the rainy season, commences in April and continues till August; but the temperature is never so low as to be disagreeably cold, and, indeed, frost is seldom experienced.

Productions.—The whole surface, both of the level land and of the moderate heights of Chili, is covered with various and luxuriant vegetation. As in other parts of South America, so here also vast tracts are usurped by wood, or abandoned to pasturage. Wheat and rye, barley and beans, with other kinds of corn and pulse, are extensively cultivated. Chili is thought by some the native country of the potatoe, of which two species, and at least thirty varieties, are enumerated. Fruits, such as the pear, the peach, the grape, the orange, the lemon, and the citron, grow in profusion, and to great perfection in the open fields, the same tree displaying at the same time the incipient bud, the expanded flower, and the mature fruit. Dye stuffs and drugs of various kinds, and of excellent qualities, are produced spontaneously, and in great abundance. Cotton, sugar, and tobacco, especially the latter, are also raised in considerable quantities.

Animals.—The indigenous quadrupeds of Chili are in general the same as those which inhabit the upper provinces of Buenos Ayres, as the vicugna, the guanaco, and the chilihueque, which, in nature and form, resemble the camel; the *guemel*, of the size and shape of the ass, but has short pointed ears; the *viscacha*, which unites the qualities and exhibits the manners both of the fox and the rabbit; its fur is manufactured into hats; the *puma* is the most formidable of the beasts of prey. These, with four or five different species of the armadillo, and abundance of ferrets, pole-cats, wild-dogs, and mice, are the principal native beasts of this region. But European animals, as the horse, the cow, the sheep, the goat, and the hog, were early imported into Chili, have greatly improved in size and beauty, and have prodigiously multiplied.

The feathered tribes of Chili are numerous and various; of the order *accipitres* are vultures, falcons, eagles, and owls; of the order *picæ* are parrots and crows. The *theuca* inhabits this region, as well as other parts of South America; it is a bird of song, and, from the simultaneous variety of its tones, it has been called the bird of a *hundred tongues.* Humming birds, arrayed in the most splendid plumage, are also numerous; but aquatic birds, both web-footed and waders, such as gulls, geese, and pelicans, flamingos, herons, &c. are still more numerous. There are also partridges, pigeons, and domestic fowls in abundance. The reptiles and insects are described as disgusting in their appearance, but not particularly noxious in their qualities. The serpents are few and harmless; musquitoes are not troublesome; still, however, there are scorpions and poisonous spiders. Whales and seals frequent the coasts, which, with the rivers, are well stored with excellent fish.

Inhabitants.—The population of Chili has been stated at 320,000, of which 80,000 are Europeans, or Creoles, the rest Indians, negroes, and half-casts descended from them. This number is evidently not proportioned to the extent and fertility of the country, and is said to be now augmenting in consequence of the removal of impolitic restrictions, which acted as checks to the increase of population. The Spaniards and the Creoles are robust, active, and enterprising, fond of magnificent display, and given to hospitality. The women are beautiful and accomplished, having regular features, fine eyes, and elegant figures, excelling in dancing and music, and other fascinating acquirements. The higher ranks dress in cloth of gold and silver, fine linen, and Flanders lace; they plait their hair into fanciful forms, and adorn it with diamonds; they sit on cushions after the Moorish fashion, drink Paraguay tea twice a day, and eat most of their meals highly seasoned with red pepper.

Negroes are not employed except for domestic services, and therefore few are imported. The Indians on the coast have been described as low in stature, with flat faces, sunken eyes, large mouths, and small chins. But the mountaineers are represented as a gigantic race, dressed in skins, and dwelling in tents.

Cities.—The southern part of Chili is still in the possession of the Indians, who have hitherto maintained their independence;—that part of it which extends from Peru to the 37th degree of south latitude, has been conquered, and is occupied by the Spaniards. This portion of the country has been divided by its new masters into thirteen provinces, and studded with numerous cities. St Iago, the capital, stands on the bank of the river Mapocho, which traverses the fertile plains of the province of Santiago. St Iago has about 50 thousand inhabitants. Conception is built on the bay of that name,—by far the finest harbour on the coast of Chili. The town contains about 13,000 inhabitants. Valparaiso is, however, the principal sea-port town of Chili; the harbour is safe, and well frequented by traders. The other considerable towns of Chili, are Copiapo, Coquimbo, Quillota, San Filipe, Melipilla, Rancagua, San Fernando, Talca, Chillan, and Valdivia, all capitals of provinces. The streets of these cities are wide and straight, and generally intersect each other at right angles. Burnt and unburnt bricks are the materials chiefly employed in the construction of the houses, few of which exceed one story, on account of the danger of earthquakes. These awful agitations to which this otherwise delightful region is liable, have at different times laid Conception and some of the other cities in complete ruin. The southern side of the country is most liable to the alarming visitation of earthquakes.

Commerce.—Chili exports to Peru, grain, fruits, wine, dried meat, leather, tallow, timber, copper, and cordage, and imports in return, cotton cloth, sweetmeats, oil, earthen ware, and all sorts of European commodities. To Spain she imports precious metals, hides, and wool. With Buenos Ayres, Chili ex-

Chili. changes linen and woollen stuffs, sugar, wine, and brandy, for Paraguay tea, wax, and negro slaves. The principal commodities of home traffic, are blankets, carpets, quilts, skin coats, stockings, hats, and saddles, which are manufactured as well as consumed in the country.

Government.—The viceroy, or chief officer of Chili, is at the head both of civil and military affairs, and has authority over the governors of Chiloe, Valdivia, Valparaiso, and Juan Fernandez. He is also president of the supreme tribunals of St Iago, in which appealed civil, and the highest criminal causes, are tried. The municipal magistracy of the towns is similar to that of old Spain. In the present disturbed state of the Spanish colonies, nothing can be said with certainty respecting the military force of Chili. The ecclesiastical jurisdiction of the country is committed to the bishops of St Iago and Conception; a considerable number of monasteries are dispersed over the country, several of the fraternities of the Romish Church having here obtained permanent establishments.

History.—Chili was subjected to Spain by the conquerors of Mexico and Peru. The natives bravely defending their country, were doomed to suffer, from these blood-thirsty ruffians, the most shocking cruelties. After the fall of Almagro, the Spanish general, the command, by the appointment of Pizarro, devolved on Valdivia an experienced and able officer. About the middle of the sixteenth century, this general had pushed his conquests far to the southward, had founded St Iago, and several other towns. The Araucanian Indians were the most formidable enemies that opposed the progress of Valdivia in the accomplishment of his designs upon Chili. Numerous battles were fought with various success, but dreadfully bloody on both sides. At length Valdivia fell the victim of his own ambition; he was made prisoner in a decisive battle gained by the Araucanians, who, to revenge the calamities he had brought upon them, and to prevent the recurrence of similar evils, dashed out his brains with the blow of a club. The next commander of note, after the death of Valdivia, was Garcia de Mendoza: he made rapid progress in subduing the country and occupying the ground which he gained; he and his men traversed the wilderness they had made, and accidentally discovered the Archipelago known by the name of Chiloe, and were kindly received by the unsuspecting inhabitants of these islands. During these wars, the Indian chiefs, Lautaro, the Caupolicans, father and son, Antigurnu, and Pailamachu, performed, in succession, many gallant, and general-like achievements, which have rendered their memory illustrious in the records of the country which they so bravely defended. The English, in the year 1586, under Sir Thomas Cavendish, made an unsuccessful attempt to supplant the Spaniards in Chili. The Dutch also, by repeated efforts, endeavoured to obtain possession of a country so well fitted, as they supposed, to gratify the spirit of avarice with which they were actuated. But the natives heartily united their strength to that of the Spaniards to repel these invaders, who were soon obliged to abandon their enterprize. The Araucanians, however, never lost sight of their own independence; and at last, in 1773, they succeeded in obtaining a peace from the Spaniards, by which it was publicly acknowledged, and which they have hitherto maintained.

During the European wars which succeeded the French revolution, Chili, with the rest of the Spanish colonies, was actuated with the desire of throwing off their allegiance to the mother country. This revolution of sentiment quickly excited a violent civil commotion through the whole of the Spanish provinces of South America. That of Chili eagerly took measures to obtain its independence, from which the only consequences that have hitherto resulted, have been altercations, battles, and bloodshed; and which of the parties shall ultimately prevail, it is impossible at present to determine.

Chiloe. CHILOE, a large island of an oblong form, a few leagues distant from the coast of Chili, between the 41° and the 44° of south latitude, constitutes, with about 80 others of smaller dimensions with which it is associated, the archipelago of Ancund. About 30 islands only of this group are inhabited, of which that of Chiloe, or Ila Grand, as it is also denominated, is by far the most considerable. The surface of Chiloe and its associates is much diversified with high mountains, deep vallies, and thick forests. The temperature is mild, but the atmosphere is deformed by clouds which invelope the country in humid fogs, or heavy rains, (accompanied occasionally with hurricanes) during the whole year, except in the season of autumn, which in general is dry and clear.

The soil is for the most part rocky and unfit for cultivation, except in the vallies. But the tillage of the small spots which are fit for the plough, is extremely rude and imperfect, being little better than surface-scratching to cover the seed after it is sown. Maize, wheat, barley, pulse, and potatoes are the principal crops, which, however, in consequence of the excessive moisture of the climate, are frequently cut down before they are quite ripe, and are dried in sheds and barns. This archipelago can boast but few fruits, and those which it has seldom arrive at maturity, except strawberries, which grow wild and in great abundance. Among the forests which cover the mountains are many valuable sorts of wood, especially the red cedar, which splits into smooth regular boards by means of wedges.

Otters, deers, and black foxes are the wild animals most frequently met with in these islands. The settlers have great flocks of sheep, and herds of cattle and horses; hogs are also reared in great abundance, and the hams of Chiloe are reckoned the finest in South America. Their domesticated fowls are likewise numerous and various, the most singular of which is the *quethu*, a species of penguin about the size of the common duck, the plumage of which approaches to the nature of fine wool. The creeks, and coast, and mouths of the rivers, teem with fishes of almost every species, which are taken in immense multitudes. Whales and seals also frequent the coast of these islands, and among the latter is the *lume* or sea elephant.

The towns of the archipelago are Castro, the capital, situated about the 43° of south latitude; Chacao the principal sea port, and the residence of the governor, till supplanted in both these points of superiority by San Carlos, which, though founded as late as 1786, already excels all the other towns both in population and riches.

The population of the archipelago is said to be about 41,000, of which 26,000 are Indians, and the rest Spaniards and Creoles. They cultivate the soil, employ themselves in fishing, in the manufacture of woollen and linen cloth, and in various other branches of industry. Their commerce is carried on with Chili and Peru, with which they barter hams, dried fish, timber, wool, and other articles of their produce for sugar, wine, brandy, tobacco, salt, herb of Paraguay, and European goods.

A Spanish governor presides over these islands, and in the city of Castro a magistrate is appointed to determine the private suits of the Indians. They are divided into three parishes which belong to the diocese of Conception in Chili. The natives readily embraced the Christian religion, and are described as a quick, hardy, and ingenious race. The Creoles are said to be robust, healthy, and well favoured.

CHILTERN, a chain of chalky hills, which stretches along the southern part of Buckinghamshire. The same name is applied to the hilly districts of Berkshire and of some other counties. The jurisdiction of the hundreds, into which many of the English counties were divided in the time of Alfred, was originally vested in peculiar courts, and afterwards devolved to the county courts, with the exception of the Chiltern Hundreds, which still retain their own courts, and are annexed to the crown, by whom a steward of those courts is nominated; and this appointment, as it has a small salary attached to it, is sufficient to vacate a seat in parliament. The nomination to this office, or the acceptance of the Chiltern Hundreds having this effect, is resorted to for this purpose.

CHIMÆRA, in ancient fabulous history, was a monster which sprung from Echidna and Typhon, had three heads, that of a lion, a goat, and a dragon, and was constantly throwing out flames. The upper part of the body resembled that of a lion, the middle that of a goat, and the hinder parts those of a dragon. Lycia was the place of its abode; and during the reign of Iobates, the monster was conquered by Bellerophon, mounted on the horse Pegasus. The foundation of this story is said to be a burning mountain in Lycia, whose summit was the resort of lions, the middle region was fruitful and covered with goats, and the marshy ground at the bottom abounded with serpents. The destruction of the wild beasts on the mountain so as to render it habitable, is interwoven in the fable of the conquest of the Chimæra by Bellerophon. But the explanation given by Plutarch, is, that the captain of some pirates adorned their ships with the figure of a lion, a goat, and a dragon.

CHIMNEY is that part of a building in which the fire is made, and from which a tube or funnel proceeds to convey the smoke to the external air. The word derived from the Greek, through the Latin and French, signifies *a chamber*.

Chimnies are supposed to be comparatively of modern invention, and the allusions made by ancient writers to smoke proceeding from houses, seem to refer to its passage by the doors and windows. No traces of chimnies have been discovered in the common dwelling-houses at Herculaneum. Columella recommends the roofs of kitchens to be made so high, as to preclude the danger of catching fire,—a pretty clear proof that a funnel for carrying off the smoke was not in use; and Vitruvius and other ancient architects, in describing the different parts of a dwelling house, make no mention of their construction.

The first notice of chimnies which is preserved, is an inscription at Venice, which relates that, in the year 1347, many chimnies were thrown down by an earthquake. But it is alleged that they were in use at Padua long before that period. The first chimnies seen at Rome were constructed in 1368, by masons and carpenters whom Francesco de Carraro, lord of Padua, brought with him. Over these chimnies he affixed his arms, which were seen in 1405. See *Beckmann's history of Inventions*, Vol. II.

CHINA.

China, the greatest empire of the east, when viewed in reference to the whole extent of its political influence, comprehends the principal part of all those countries which lie between the 20° and the 55° of north latitude, and the 85° and the 147° of east longitude,—an expanse of surface at least 4000 miles long and 2000 miles broad; bounded on the west by Kalmuck Tartary, on the north by Siberia, on the east by the ocean, and on the south partly by the Chinese sea, and partly by the countries of the eastern peninsula of India. And besides this immense extent of territory, subject to the sway of the great emperor, all the conterminous states, such as Tong-king, Laos, Cochin China, Birmah, Tibet, Corea, and many groups of islands scattered over the face of the eastern ocean, own his paramount power, seek his protection, and pay him tribute. The country, however, properly denominated China, is confined within narrower limits. This important and far-famed region is situated in the eastern extremity of Asia, stretches between the 20° and the 41° of north latitude, and the 98° and the 122° of east longitude; is almost half encircled by the sea, and, proceeding from the south, borders with Tong-king, Birmah, Tibet, and Tartary.

Mountains.—The mountains, lakes, rivers, and plains contained within these limits, seem, from the proportion they bear to each other, as if intended by nature to constitute one great whole, complete in all its parts. Vast ranges and groups of mountains diversify the surface of all the western and most of the southern provinces, the summits of which are in many places elevated more than 15,000 feet above the level of the sea. All these mountains are mere prolongations and ramifications of that stupendous chain which traverses Tartary, and which a fanciful eye might regard as the back-bone of the continent of Asia. These mountains descend along the northern border to the sea-shore in the peninsula of Corea; branches extend themselves along the western line of demarcation to the sea on the south, forming in many places an insuperable border-barrier by means of their precipitous steepness and towering elevation; and many ramifications shoot out from these western mountains, and penetrate far eastward into the interior of the country. One of these secondary chains separates China from the kingdom of Tong-king, and lines the coast of the gulf of Tong-king almost to the bank of the river which washes the walls of the city of Canton. About two hundred miles more to the north a parallel chain of still greater magnitude, denominated the mountains of Melin, stretches eastward within 60 or 70 miles of the Yellow sea, where it bends toward the north, and terminates near the 30th parallel of north latitude. The general height of the summit of this chain is 8000 feet above the level of the sea, and from it many branches extend, chiefly toward the north. The whole of that part of the country, which is comprehended within the 30° and 40° of north latitude and the western border, and the 115° of east longitude, is also much diversified by mountains. The sides of these mountains exhibit every variety of precipice, and sloping declivity, which, in some places, assume every fantastic shape of savage wildness, and in others are clothed with verdure, and adorned with flowers, and shrubs, and trees. The summits in some places rise in a series of serrated peaks penetrating the clouds; in other places they expand into wide fields of table-land, or are covered with vast forests and rich pastures. The ravines and glens, the vallies and plains, which stretch between the mountain-chains, are at least as much diversified by sterile desolation, picturesque grandeur, soothing amenity, and various vegetation, as those of any other country on the face of the earth.

Mineralogy.—" Almost all the mountains," says Barrow, " that occurred in our passage through China, were of primitive granite, some few of sandstone, and the inferior hills were generally of limestone or coarse grey marble. Except the Ladrone islands on the south, and some of the Chusan islands on the east, we observed no appearance in the whole country of volcanic formation. The presence of a vast volume of water seems to be indispensibly necessary to carry on this operation of nature; and accordingly we find that volcanic mountains are generally close to the sea-coast, or entirely insulated. Thus, although a great part of the islands on the coast of China are volcanic, we met with no trace of subterranean heat, either in volcanic productions or thermal springs, on the whole continent. Yet earthquakes are said to have been frequently felt in all the provinces, but slight and of short duration." The mountains between Pekin and Tartary slope backward, and present on the opposite side steep naked rocks, distinctly stratified. These strata, proceeding from below, are generally sand-stone, coarse-grained limestone, studded with blue-coloured nodules, indurated clay, more or less impregnated with iron, and, above all, huge overlying masses of granite.

The metallic ores and mineral productions of the Chinese mountains are various and valuable. Numerous veins of gold and silver have been discovered, but the working of them is discouraged from political considerations. A good deal of gold, however, is collected from the sand of the mountain-streams. Mines of copper, iron, tin, lead, and other metals, are open and productive; and quarries of stone, marble, and coal, are abundant in most of the mountain districts. A sonorous stone, called yu, of which musical instruments are made, is found in the beds of torrents; lapis lazuli, rubies, rock-crystal, &c. are also among the products of the Chinese mountains.

Rivers.—Innumerable torrents and streams flow from the mountains and hills of China, which diffuse freshness and fertility through all their vallies. But the sources of the great rivers of the country lie in the towering heights of Tibet, whence also the great rivers of India and Siberia begin their long and majestic career. Hoang-ho, the Yellow-river, issues at first from highly-elevated mountain-lakes in Tartary; and, after a devious course of more than one thousand miles, in which it makes only occasional incursions into the territory of China, till, in its rapid career, it takes, about the 41° of north latitude, a sudden turn towards the east, and afterwards rolls its constantly accumulating volumes of water through the heart of that country, and, after a circuitous course of more than 2150 miles, it loses itself in the sea. The impulse which this river receives at its source is so great, and the water which it collects from its tributary streams is so inmense, that though the breadth of its channel seldom exceeds an English mile, yet, from the depth and velocity of its course, it is said to supply the sea with a thousand times more water than the Ganges with all its mouths. These waters are mixed with mud, which gives them a yellow tinge; and from that circumstance, both the river which they form, and the sea through which they are diffused, have derived their name.

Yang-tse-kiang,—the son of the sea,—the other great river of China, flows from the same mountains which enclose the sources of the Yellow river. It enters China between the 26° and the 27° of north latitude, and, in a very circuitous course, traverses the provinces of Yun-nan and Se-tchuen, separates those of Ho-nan and Quang-su, glides smoothly through that of Kiang-nan, and when it has flowed 2200 miles, it falls into the sea opposite to the island of Tson-ming, and about 150 miles south of the estuary of the Yellow river. These two majestic streams, though they thus approach each other at their sources and at their mouths, are yet at some points of their progress at least 15 degrees asunder, and enclose a country which, in ancient times, constituted the principal part of the empire.

The river Pei-ho rises in Tartary, and flows eastward to the south of Pekin, unites with the Yun-leang-ho, *the grain-bearing river*, at the city Tien-sing, thence it continues its course through level plains, which it sometimes inundates, till, at the 39° of north latitude, it fall into the gulf of Pe-tche-lee, which it is gradually filling up with mud deposited by its waters.

The Melin mountains, which run from east to west between the 25th and 27th parallels of north latitude, give rise to the river Kan-kiang-ho. It takes a northerly direction across the province of Kiang-see, which it enriches and beautifies; and, after a course of about 300 miles in length, it pours its streams into the lake Po-yang. The banks of this river are skirted with large trees, and it winds its way among mountains rich only in picturesque beauty. In one place it is impeded by ledges of rock which run across its channel, forming a series of rapids called the eighteen cataracts, the scene of many a Chinese shipwreck. The mountains, through which this river has scooped for itself a channel, are covered with forests of fir, and their vallies abound with plantations of bamboo. The country in the neighbourhood of the cataract is extremely beautiful; the stream is transparent; the rocks are bold and finely fringed with wood; and the mountains, at different points of view, assume a variety of picturesque and delightful forms.

The river Pei-kiang-ho descends to the south from the same range of mountains from which that just described begins to flow. This is the river which passes the city of Canton, from which, upward to its source, is fully 300 miles, and downward to the sea about 80 miles more. The upper part of this course lies between two parallel ranges of calcareous hills, which in some places rise to a sublime height, and in a gloomy and threatening aspect frown over the river. The estuary by which the Pei-kiang-ho enters the sea is spacious, studded with islands, and known to Europeans by the name of the Bocca Tigris.

Many other great rivers traverse the province of Yu-nan, Quang-see, Canton, and Fo-kien, by the mouths of which the southern coast of the country is deeply indented. The river Tat-cin-ho traverses the provinces of Chan-tong, and discharges its stream into the gulf of Pe-tche-lee, about the 27° of north latitude. Most of the lesser streams of the interior flowing from the west are intercepted by the course of the imperial canal, which extends across the country from north to south; and the lakes of the country are at once the receptacles and the sources of innumerable streams.

Lakes.—The lakes of China are of two descriptions, those of the mountains and those of the plains. The surface of the upland districts, and especially that of the province of Yu-nan, is diversified with frequently occurring and widely-extended collections of water, lodged in the depressed and pent up places of the glens and the vallies. The lakes of the plains are in general mere dilatations of the rivers, or the estuaries in which they terminate; and they are so numerous and so expansive, that, inclusive of the marshy places with which they are associated, they are supposd to occupy a full fourth part of the whole surface of the low country. The plains of China, boundless as they seem to be, and fertile as they have become, are all obviously usurpations of the land upon the once undisputed domains of the water; conquests gained by the land over the ocean in the course of revolving years. This enlargement of the land is a process still in active operation; and is effected entirely by the continued deposition of alluvial matter. The Yellow sea, with all its creeks, and bays, and gulfs, is by this means daily becoming less deep, and more broken with banks and islands, so that at some future period it may be converted into green meadows and fruitful fields. For although this sea, when raised by the tides, and aided by the mountain floods, asserts its ancient prerogative, and overflows the low-lying plains, rendering them for a while one wild and tumultuous waste of water,—yet every time these waters retire from their incursions, they leave behind them, on all the land which they had covered, a new coat of soil, by which it is enriched, and which helps to form a barrier against their future aggressions. The Yellow river alone, according to a very moderate calculation, carries daily into the sea mud to the enormous amount of 48 millions of solid feet; the constant accumulation of which, together with proportionate quantities carried down by the other rivers, must in a short time produce very sensible effects, both on the elevation and the expansion of the plains.

Thus the expansive plains of China owe their existence to the *debris* of the mountains of Tartary; and the lakes and swamps, which still diversify their surface, are the remaining traces and sure indications of the original condition of the place which they now occupy.

The Po-yang, the largest of these lakes, lies between the 28° and the 30° of north latitude, in the province of Kiang-see, and receives rivers from most points of the compass, the water of which, collected into one stream, forms one of the tributaries of the *Son of the sea.* This lake, with its marshes, is said to be more than 100 miles in length, and is justly denominated an inland sea. Two hundred miles to the westward of the Po-yang, in the province of Hoo-quang, a labyrinth of lakes spreads over an extensive surface on both sides of the river Yang-tse-kiang. Of this group the lake Tong-ting is the largest, being almost 300 miles in circumference. Its form is irregular, and many rivers of various sizes flow into its bosom.

A great part of the course of the imperial canal lies through a dreary waste of morass, which sometimes assumes the appearance of the boundless ocean, interspersed with islands, and covered with fishermens huts. When these occasional floods subside, the district still retains numerous groups of large and permanent lakes, among which are the Po-yang, much frequented for fishing; the Lema to the west of the canal; the Tai, extended at the feet of picturesque hills, and many more, dispersed over the space which intervenes between the two great rivers.

Climate.—The temperature of a country so far extended from south to north, and so broken in its surface as we have seen that of China to be, will of course vary with the latitude under which its different provinces are placed, and with the elevation to which its mountain summits attain. Accordingly, the summer heat of Canton, which lies within the tropic of Cancer, frequently raises the mercury in Fahrenheit's thermometer above the 100° of the scale; while the winter cold of Pekin, situated in the 39° of north latitude, sinks it sometimes below zero. The gentlemen of Lord Macartney's suite found the range of Fahrenheit's thermometer, in the north, from the beginning of August to the end of October, to be between the 88° and the 44°. Little rain fell in all that period, and the sky was dry, clear, and, salubrious. But the rivers, canals, and lakes of these regions are, in winter, fast locked up by intense and continued frost; while, in the south, ice and snow are seldom seen, even in the coldest seasons, and though the heat be sometimes high, it is not often oppressive. In the extensive regions which intervene between these extremes of heat and cold to which the opposite sides of the empire are exposed, the most delightful temperature (except high among the mountains,) is every where enjoyed. In these far-spreading plains and long-drawn vallies, the atmosphere is seldom darkened with clouds or disturbed with storms; and, with the exception of a few weeks in winter, which are gloomy, rainy, and cold, and at the vernal and autumnal equinox, when the wind blows in boisterous gales, veering suddenly from one direction to another, the year glides away in calmness and serenity, the heavens all the while dropping down fatness upon the place beneath, and nourishing to maturity the richest variety of vegetable productions.

Vegetables.—Almost every species of plant which is found to flourish in the same parallels of latitude is indigenous to the soil of China, with a multitude of others rarely if ever to be met with any where else. Both gramineous and leguminous crops are raised in great variety and abundance throughout the country. A kind of kale, not unlike cos-lettuce, is produced in vast quantities in the vicinity of the capital and other great cities, as well as all those herbs commonly cultivated in the kitchen-gardens of Europe, and especially onions and garlic, and other pungent plants. The ponds and lakes throughout the empire are adorned with the water-lily, the lien-hoa of the Chinese, and the nelumbium of botanists. The root of this plant attaches itself to the bottom of the water, and it is sustained on a stalk, which rises to the surface, of a length and thickness proportioned to the depth of the water in which it grows. The leaves, which are large, thick, and fibrous, float on the surface of the water, and the flowers have the property of opening and shutting with the rising and the setting of the sun. There are several species of this plant, and, according to the species to which it belongs, it blooms with pink or pale coloured flowers, rendering every expanse of stagnate water, and every slowly flowing stream, as it were a gay parterre. The seeds of this plant are good for food, and are eaten as filberts; the roots, and stalks are also edible, and are preserved and pickled in various ways for that purpose. All the different sorts of European fruits are common in China, such as apples, pears, plums, peaches, apricots, grapes, oranges, lemons, and citrons; some of these fruits are but of inferior quality, but the oranges are excellent. Pine-apples, figs, almonds, tamarinds, mangees, with other produce of tropical climes, grow abundantly in the southern provinces. The Lee-tchee, a kind of date; the Lin-kio, and the Peetsee, species of water chesnut: the Long-yan, of an acid and juicy nature; the Tche-tse, a fig of an excellent quality, and several other sorts, seem to be fruits peculiar to the country. Vast forests of timber trees crown the summits and clothe the sides of the loftiest mountains, in which are all the varieties of the pine tree, the oak, the ash, the elm, with the other kinds that clothe the woodlands of Europe. But with these, many others of peculiar qualities are associated,—such as the Chinese sycamore and cedar, the iron wood, and the rose-wood trees, both of which are of the tallest growth, and suited for the most useful purposes; the Camphor-tree, a species of laurel, of tall and stately growth, from which camphor is obtained; the Tallow-tree, so called from a pulpy, oily matter, possessing the properties of *tallow*, found in the kernels of its fruit; the varnish trees of which the liquid expressed from the fruit of one sort, and that which exudes from the trunk of another, form a glossy and durable varnish for articles made both of wood and metal; the wax tree, so called from a kind of wax deposited on its leaves by insects, said to be superior to that produced by bees. Du Halde speaks of a lofty and umbrageous tree, which yields plenty of good *peas*. The bamboo, a hollow knotty reed, grows freely, and in great abundance in most of the provinces, and is applied to an endless variety of useful purposes. The cotton shrub, both the common and the nankin kind, with plantations of the sugar-cane, tobacco, and indigo, and groves of mulberry trees, cover much of the surface of the southern side of the empire. The Betel plant, the leaf of which is in such general request throughout the east, is found, like the ivy of Europe, clinging to the trunks of the forest trees, as well as many other kinds of creeping parasites. The Gin-seng, much esteemed for its restorative and invigorating qualities, grows in the mountains among the weeds, and is guarded and gathered by soldiers for the use of the emperor. The Camellia Sasanqua, a shrub which bears a strong resemblance to the tea plant, both in its general appearance, and in the size, shape, and colour of its leaves, is cultivated on the highest summits and the rocky cliffs of many of the mountains: This shrub yields a nut, whence an esculent oil is expressed, equal to the best which comes from Florence. The tea shrub itself,—the fragrant leaves of which are so familiar, and now thought so necessary to the comfort of Europeans,—is one of the indigenous plants of the fertile provinces of China. A vast variety of other herbs, and trees, and fruits, and flowers, from which drugs and dye stuffs are extracted, which are useful for food, or which deck the landscape, grow spontaneously, or are raised by culture throughout the diversified territories of this great empire. Lists of such Chinese plants as were collected or examined by the gentlemen of Lord Macartney's suite, in provinces which they traversed, will be found in Sir George Staunton's Account of the British Embassy of 1793-4.

Animals.—Travellers agree in representing both the quantity, the quality, and the variety of animal existence, (the human species alone excepted,) as extremely limited and defective in China. Few cows or bullocks are reared, either for the dairy or the shambles. The best horses in the emperor's stud, or which compose his cavalry, are not to be compared to a drove of uncombed ponies from the Highlands of Scotland. Grey buffaloes, with straight horns, mules, and asses are kept, though not in sufficient numbers, by the farmers for the labours of husbandry. Broad-tailed sheep, in numerous flocks, pasture in the upper regions; and a very prolific, and withal, as it is said, a cleanly kind of hog, is reared in almost every cottage, and constitute valuable articles of food. The woods, and the wilds of the mountain regions, are the retreats of the elephant, and the rhinoceros; of the camel and the dromedary; of the leopard, the tyger, and the wolf; where also apes, monkeys, and squirrels, deer, antelopes, and goats of several sorts, hares, rabbits, and other kinds of game, are said to be abundant.

Many of the birds of Europe, and most of those of Asia, are found in the different provinces of China. Poultry, pigeons, geese, quails, and multitudes of ducks, are bred for the tables of the rich. Eagles, falcons, and hawks, are seen among the mountains; birds of paradise, pheasants, parrots, and peacocks, inhabit the woods; swans, storks, herons, cranes, pelicans, gulls, and others of the web-footed and the water tribes, frequent the swamps, the lakes, the sea coast, and the Chinese islands.

Among the insects of China are the silk-worms, bred for their much esteemed produce over a great extent of the southern side of the country. A kind of caterpillar,—which feeds on different kinds of leaves, and which spins a sort of silk, not in balls, but in threads, stretched between the bushes by which it is sustained, is common enough in some places. The stuff spun by this insect is carefully collected, and manufactured, and in that state brings a higher price than common silk. Moths and butterflies of great beauty, and of extraordinary size, are numerous in the south, some of which are occasionally preserved and sent as presents to the emperor. In dry seasons, grasshoppers or locusts are produced in such amazing multitudes, and spread such wide devastation, as to cause the most afflicting famines.

As the great lakes of China communicate with the sea by means of the rivers, the spawn of a vast variety of fishes is deposited in the sand of their shores; from which the lakes, the rivers, and the sea itself are constantly supplied with inexhaustible shoals,—and thence multitudes of the poor derive their sustenance, and the rich one of their luxuries. Among the different species of the fishes of China, is one of large size, which is said to eat like veal; a species of cod also, of a bulk not inferior to that which frequents the coasts of Newfoundland; a kind called the flour-fish, from the whiteness of its colour; the salmon, the trout, the herring, the sturgeon, the pike, and the sole, are likewise produced in the prolific waters of China.

Provinces.—The extensive, and diversified surface of China is divided into fifteen provinces, six of which are maritime, five midland, and four upland.

1. Pe-tche-lee, the most northern of the whole, is of a triangular form, is comprehended between the 44 and the 41 parallels of north latitude, and spreads over a surface of 58,949 square miles. The western and northern parts of this area are mountainous, the rest is a wide level plain, of a light sandy soil, but little raised above the surface of the stream of the river Pei-ho, by which it is watered, and occasionally inundated. It produces millet, wheat, culinary vegetables, and fruits. The mountains are covered with forests, and contain metals, marble, and coal. The cities, among which is Pekin, are nine of the first order, and 140 of the second and third.

2. Chang-tong lies to the south of Pe-tche-lee, and comprehends an area of 65,000 square miles. A peninsula, crowned with cone-shaped hills, juts far into the Yellow sea, and forms the southern shore of the gulf of Pe-tche-lee. The climate on the coast is mild, and the soil is fertile, yielding grain, pulse, cotton, and silk; but the interior is full of lakes and fens, which chill the atmosphere, and which check vegetation. Numerous wolves are said to haunt the cultivated fields, gangs of robbers infest the highways, and swarms of locusts in dry seasons devour every green thing. This province contains six cities of the first rank, and 114 of the second and third.

3. Kiang-nan, or Nan-king, extends to the south of Chang-tong, between the 30 and the 34 parallels of north latitude, and comprehends 92,961 square miles. This province is traversed by both the great rivers, and is interspersed by numerous lakes; and as well as the two situated to the northward, it is intersected by the course of the imperial canal. The soil is very fertile, and every spot is highly cultivated with wheat, rice, fruits, cotton, and silk. The cities of the first rank are 11 in number, and those of the second and third are 98.

4. Tche-kiang stretches from the border of Nanking, about 260 miles along the coast. In point of situation, extent, fertility, and trade, this is one of the most considerable provinces in the empire; it is well watered with rivers and lakes, and diversified with hill and dale; its mountains are covered with woods, and contain valuable minerals; its vallies and plains are populous, cultivated, and fruitful. It is noted for its groves of mulberry, plantations of bamboo, curious plants, various flowers, and still more for its silk and cotton manufactures. It has eleven cities of the first rank, and 72 of the second and the third.

5. The province of Fokien occupies the south-east division of the empire, and has about 300 miles of sea coast, deeply indented by bays and gulphs, which form excellent harbours. The surface, which extends over an area of 53,483 square miles, is diversified with mountains, in which are mines of gold and silver, and which contain various kinds of precious stones. Grain, fruits, cotton, sugar, silk, and tea, are produced in this province in great abundance. It has nine cities of the first rank, and 60 of the second and third.

6. Kang-tong, the most southern of the maritime provinces, extends almost 180 leagues along the sea coast, and about 50 from south to north, and comprehends the wide space of 79,456 square miles; the whole of which is finely diversified with mountains and hills, narrow vales and expansive plains. The richest silks and the finest teas are produced in this province; and it has ten cities of the first, and 48 of the second and third order.

7. Quang-see, the most southern of the inland provinces, lies between the 23° and the 26° of north

China. latitude; its surface is of an oval form, and spreads over a space of 78,250 square miles in extent, marked with mountains and plains, and watered by numerous streams. This province is well cultivated, teems with rich and various vegetation, and is studded with 12 cities of the first, and 80 of the two inferior orders.

8. The province of Kiang-see is interposed between Quang-tong on the south, and Nan-king on the north, and comprehends a surface of 72,176 square miles. The southern side of the province is traversed by the Melin mountains, which are rich in metals and minerals. The great lake, Po-yang, is in this province, and the face of the country is every where finely diversified. There are here 13 cities and 72 towns.

9. The province Hou-quang, extends from the confines of that of Quang-tong, 17 leagues toward the north, and spreads over a surface of 144,770 square miles; and is so rich in metals and gems, in fruits, grain, cotton, silk, sugar, and pastures, that it has been styled the storehouse of the empire. The great Yang-tse-kiang-ho, with many other rivers, intersect and traverse this province; its lakes are also large and numerous; and it contains 17 cities, and 114 towns.

10. Ho-nan is 65,104 square miles in extent, and is situated toward the centre of the empire. In the bombastic style of the country it is called the middle flower, and the garden of China. Except the northern corner, which is hilly, the whole of this province is a level fertile plain, well watered with streams communicating with the Yellow river, and is every where highly cultivated. It has eight cities, and 120 towns.

11. Koei-cheou, a comparatively barren, and thinly inhabited province, comprehends a space of 64,554 square miles, extended between the 26° and the 30° of north latitude. This region abounds with rugged rocks and inaccessible mountains, which however contain mines of gold, silver, and copper and between which are many fertile and well watered vallies. Disgraced mandarins are sometimes punished by being sent to this province, which contains ten cities and 38 towns.

12. Shan-see, which borders with Tartary, is situated between the 35° and the 40° of north latitude, and has a surface of 55,268 square miles. This is supposed to have been first peopled province in the empire. It is full of high mountains and long drawn vallies; it is washed on the west and on the south by the Yellow river; and is fertile and well cultivated throughout its whole extent. Some of the hills are terraced to the top, and are covered with corn and vines; others are shaded with forests, or green with pastures. From the dark caverns of the mountains are dug metals, marble, coal, and precious stones. This province contains five cities and 90 towns.

13. Shen-see, also an upland province, covers an expanse of 154,008 square miles. The mountains of this district, which are many and lofty, contain abundance of metals and minerals, and are covered with forests and pastures. A great number of the tributary streams of the Yellow river, which flows along a large part of its eastern border, traverses the interior of the province. Grain, rhubarb, wax, and musk, are among the produce of this part of China. But the climate, though temperate, is subject to long and frequent droughts; during the continuance of which, myriads of destructive insects are bred, and prey upon the herbage of the field, so that nothing on these calamitous occasions attains to maturity.

14. The province of Se-chuen borders with Tibet, from which it is separated by inaccessible mountains; it lies between the provinces of Shen-see and Yun-nan, and occupies an area of 166,800 square miles. It is divided by the great river Yang-tse-kiang, and traversed by numerous smaller streams. The mountains yield iron, tin, quicksilver, with other metals and minerals; on the surface of the country, wheat and rice, cotton, sugar, and silk, grow in great abundance. It has ten cities, and 88 towns.

15. The province of Yun-nan is situated in the south-west corner of the empire, between the 22° and the 26° of north latitude, and comprehends 107,969 square miles. This district is diversified with mountains and plains, lakes and rivers; and is rich in silver, copper, marble, precious stones, timber, grain, medicinal plants and roots, silk, and musk. It borders with the kingdom of Ten-king and the Birman empire, both of which are tributary states. It contains 21 cities, and 55 towns.

Islands.—The Chinese and the Yellow seas are studded with numerous groups of islands, which, in so far as they are subject to China, are comprehended under the jurisdiction of the adjacent maritime provinces. Hai-man, one of the most considerable of these islands, is of an oval form, lies between the 18° and the 20° of north latitude, and is intersected by the 110 parallel of longitude east of London. It is separated from the peninsula of Ley-tcheou, by a strait three leagues in width; it is about 200 miles in length, and 90 in breadth; the interior is mountainous, and inhabited by an independent tribe; the coast is in general level, fertile, and cultivated, and yields grain, fruits, cotton, indigo, and very fine and fragrant rose-wood. This island constitutes a part of the province of Quang-tong.

The celebrated island of Formosa is situated about 20 leagues east from the coast of Fo-kien, between the 22° and the 26° of north latitude. A chain of mountains traversing its interior from south to north, divides it into two parts, called the eastern and western provinces; the latter of which only is subject to the Chinese. In the mountains are mines of gold, silver, copper, and sulphur. The produce of the soil consists of timber, grain, fruits, sugar, silk, tobacco, and tea. It is populous, and has numerous towns and villages.

The Chu-san archipelago lies off the coast of the provinces of Tche-kiang, and Nan-king, and consists of about 400 distinct islands, comprehended within the space of of 800 square leagues. Of this group Chu-san is the largest; Lo-ang is also large and populous; Tsong-ming is cultivated, and is tolerably fertile; its principal trade is the extraction of salt from a grey earth, saturated with that substance. Too-too, one of these islands, is described as a perfect paradise. It is said to contain 400 temples, to each of which are annexed dwelling-houses for the accommodation of the monks, who are very numerous: this large mo-

monastery, as it may be called, is richly endowed, and its fame is spread throughout the empire.

The Ladrones, in the Chinese sea; the Pong-hoo group, in the straits of Formosa; and that of the Mee-a-tau, in the gulf of Pe-che-lee, are in general nothing else but naked rocks, or barren sand banks, frequented by fishermen and pirates.

Population.—The country to which the preceding description applies is so compact in itself as to be entirely enclosed by natural or artificial barriers, and yet so widely extended as to include climates of almost every temperature,—a country with a surface so diversified, and a soil so fertile (and withal so carefully cultivated,) as to teem with every variety of vegetable and animal produce, will of course be extremely populous. The statements of travellers, however, on this head, have in general appeared so enormous, as to exceed the belief of those even who were inclined to credulity, and, to enhance our admiration, the latest information on the subject seems to shoot farther into the regions of extravagance than any of the former accounts. While the vague surmises and exaggerated representations of the Jesuits, in other matters, have been corrected by better informed and more accurate observers, the highest of their estimates of the population has been more than doubled by that which was communicated by a mandarin to Sir George Staunton, with the assurance that it was the true result of a recent census. But every statement on the subject, from the earliest ages down to the present times, rests, it is asserted, on a foundation equally solid. Unfortunately, however, we are ignorant of the principles on which the Chinese census is taken; and therefore we are unable to ascertain the degree of credit due to the reports which from time to time have been published of them. All we know is, that their discrepances are irreconcileably great.

According to the earliest of these accounts, the population of China, at the time when the census was taken of which it is the report, was 54,000,000. In the year 1743, it was said to be 157,000.000. In 1761, it was found to be 198,214,553. But in the account which was given to Sir George Staunton, it is raised to the enormous amount of 333,000,000. In the details of which this is the startling aggregate, the population of the different provinces are exhibited in round numbers, two of which are precisely the same, pretty strong proofs of the inaccuracy of the whole.

M. de Guignes, reasoning from the obvious extravagance of this statement, from the known tendency of the Chinese to exaggerate whatever displays the importance and the power of their country, and from his own observations on the capabilities of the soil, and the state of its cultivation, comes to the conclusion that China could not possibly maintain 333,000,000, in place of which he would substitute 150,000,000, a number that still would leave China more populous than France. Mr Ellis too inclines to think that the population of China has been greatly overrated, and yet he was greatly surprised at the magnificent cities and numerous towns through which, or rather by which he passed, and at the immense and close packed crowds of people, (among whom scarcely a woman was to be seen,) that lined the whole of his rapid route through the country.

Mr Barrow, on the other hand, on comparing the estimates of the population with the extent and resources of the soil, with the division of property, and the habits of the people, is of opinion that China could be made to maintain a still more numerous population than what has hitherto been assigned to it. And Mr Malthus, in the chapter of his celebrated work on population which treats of the checks to population in China, reminds his readers that whatever abatements must be made from the gross amount of 333,000,000, all accounts concur in representing the mass of human existence in China as greatly exceeding that of other countries; that even in the poll made at the beginning of the reign of Kang-hi, as recorded by Du Halde, there were found 11,052,872 families, and 59,788,364 men able to bear arms; and yet neither the princes nor the officers of the court, nor mandarins, nor discharged soldiers, nor persons under twenty years of age, nor the multitudes that live entirely on the water, were comprehended in the number; that, therefore, were these several classes added to the account, and the 59,788,364 capable of bearing arms multiplied by four, a number rather under than over the proportion which those at a military age bear to the rest of the inhabitants of any country, the grand total will be found not to come far short of the number, great as it is, contained in the document imparted to Sir George Staunton.

But, in the absence of authentic documents from which the population of China can be calculated, the mere statement of a few undoubted facts will be sufficient to shew us that the inhabitants of this very singular country are indeed extremely numerous. The soil teems with the productions of every climate,—husbandmen are held in high consideration,—cultivation is carried from the doors of the rich to the tops of the hills,—two crops destined for the food of man are raised in most of the provinces within the year,—early marriages have been encouraged from time immemorial, and consequently celibacy is regarded in a light too disgraceful for many to persist in it; vast numbers of cities of the first, second, and third ranks are scattered over all the provinces; thousands of families live not on the land, but in barks on the lakes, rivers, coasts, and canals; and, to crown the whole, infanticide is connived at by government, and is resorted to by so many as to be awfully prevalent. These facts, familiar to all who read the details of travels in China, afford incontestible proofs that the country is oppressed with the weight of its superabundant population. Two-thirds of the population of China are supposed to be employed in the agriculture and fisheries of the country; the rest are manufacturers, tradesmen, shop-keepers, sailors, soldiers, civil officers, and students.

Agriculture.—The careful cultivation of the soil is regarded in China as of the highest importance, both for the promotion of public prosperity, and the diffusion of individual happiness. Hence husbandmen are exceedingly numerous, and treated with honourable distinction; hence too, the Emperor every year, at the return of the vernal equinox, goes through the ceremony of holding the plough. After the performance of solemn sacrifices, he repairs, accompanied by his court, to a field in the vicinity of the palace, part of which he ploughs and sows with his own hand, while groups of peasants chaunt hymns in praise of husbandry. When the Emperor has finished his task, he resigns the plough to the princes in attendance, all of whom plough and sow in succession. The produce of this imperial culture is supposed to possess qualities peculiarly valuable, and is therefore carefully collected and applied to sacred purposes. The celebration of this anniversary is published through every city, town, and village, to the utmost ends of the empire, and is also observed by the mandarins of every degree in their respective provinces and districts. This is a superstitious but a highly politic custom, which exerts a powerful and a permanent influence in exciting and cheering the labours of the field. It associates the operations of agriculture with all that is high in rank and holy in religion, places husbandmen in the scale of social distinctions next to men of letters and officers of state, and renders it respectable in priests and soldiers also to be farmers, *and to work labouring with their hands.*

Yet with all this countenance and encouragement, the Chinese, though certainly the most assiduous, are far from being the most skilful cultivators of the soil. They follow with servile imitation the modes of management which have descended to them from the remotest antiquity, and they have neither skill nor capital, nor implements, to enable them to introduce extensive improvements. As the Emperor, in the eye of the law, is the sole proprietor of the soil, every occupier of it is regarded as a tenant at will. But so long as he chooses, or is able to pay the *imperial dues*, he is secure in his possession; on his compliance with this condition, any man may appropriate as much land as he pleases, which he may again subset in small farms. This system is said to be very general throughout the empire, the great proprietor paying to government a tithe of the whole produce, and exacting from his tenant, in many cases, a full half in the shape of rent. The great body of Chinese cultivators, would therefore in Great Britain be ranked in the class of cottars; and if such be the case, we have no reason to be surprised when we are told by travellers that they have no method for draining swampy places, no instruments for breaking up waste lands, and no knowledge of the practices in use for improving the breeds of cattle.

The common plough of China is a very rude, imperfect instrument, constructed mainly of a single piece of crooked timber, to one end of which the share is fixed, while the other serves as the handle. Barrow describes a drill-plough mounted on wheels, and furnished with two parallel uprights, shod with iron, to open seed ruts, into which the seed is dropped from a happer, and covered by a transverse beam of wood, contrived just to sweep the ground behind. The harrow in most general use is a platform of planks, armed with a triple row of teeth. Carts, to facilitate the operations of agriculture, are in some places scarcely known. The draught cattle of the country are oxen, buffaloes, mules, asses, and old women.

With this inadequate apparatus, it is obvious that the excellence of the crop must depend more on the soil than the culture. The spade and the hoe indeed are the principal instruments of Chinese husbandry, by the general use of which the land is dressed in the best manner possible, and culture carried to places quite inaccessible to the plough. In the vicinity of the cities and towns, the hills, from the base to the summit, are formed into a series of terraces, each of which is supported by a parapet wall. A reservoir on the top of the hills, thus disposed, preserves the rain water, and by means of small channels diffuses refreshing moisture through the whole series of terraces on their sides. The level plains of China, which in dull monotony extend in every direction far beyond the sphere of vision, are little raised above the surface of the mighty rivers by which they are traversed, and the obvious consequence of this depression is exposure to frequent inundations. This command of water is very favourable to the culture of rice so prevalent in China; but when it takes the command, which is occasionally the case, it rages with such destructive influence as to cut off the hope of the year, and thereby to cause the most distressful famines. To prevent as much as possible the unseasonable recurrence of these wide spreading floods, the streams, especially that of the Yellow river, have been lined with stupendous embankments, by which the water, except in extraordinary cases, is excluded from the adjacent fields. It would appear from this fact that the Chinese have been rashly accused by travellers, of ignorance of the art of draining. It is more probable that there is no descent to carry off the waters of the vast swamps of which they speak, than that the ingenious and laborious race who planned and executed the imperial canal, and confined the impetuous stream of the Yellow river within artificial banks, should be absolutely ignorant of every method for draining wet and marshy surfaces.

The Chinese are well aware of the fertilizing effects of manure; but the scarcity of all kinds of cattle is greatly against the production of the sort which experience has taught to be the most valuable. Every vegetable and animal offal is, however, carefully collected. The barbers are furnished with bags, into which they deposit for this purpose every particle of lather, and hair which they scrape from the scalps of their customers. The very young and the extremely old are employed on the roads and streets to pick up every species of filth and excrementitious matter, which is moulded into thin cakes and dried in the sun. These cakes are bought by farmers and gardeners, who dissolve and apply them for enriching their land. The fat sleeky mud from the sides and beds of the rivers and canals, forms also a valuable part of the manure of the country.

In the northern provinces of China, a hedge-row, or a clump of trees, is an object of rare occurrence. Farms and fields are separated from each other by little ditches, or by narrow ridges of unploughed land like the foot paths of England; and when cropped with rice, they are subdivided into small enclosures by thin rims of clay, which serve to confine the water of irrigation. The grain commonly cultivated is buck-wheat, barley, millet, wheat, and rice, all of which, previously to their being sown, are steeped in a solution of liquid manure, a process which is supposed to promote the germination of the plant, and to preserve it from the attacks of insects. Broad-cast sowing is not much practised, in place of which the seed is drilled in rows or dibbled in checkers. The climate of the northern provinces is a great deal too severe for winter crops, the hard frosty weather usually setting in toward the end of November, and seldom breaking up before the middle of March; but in these regions vast quantities of herbs, grain, pulse, and fruits grow to maturity in summer.

The middle provinces abound with fields of wheat and rice, and with plantations of cotton and indigo. Rice being the staple of China, it is extensively cultivated in all those places which admit of irrigation, and which at the same time enjoy a sufficient warmth of climate. The general mode of managing soil of this description, is first to take a crop of wheat, which is cut down in the month of June or July, when the rice plants in the seed-beds stand at the height of about ten inches from the ground, the thinnings of which are planted out in the wheat land, previously prepared for their reception; and when the planting is finished, the field is flooded. If it be difficult to obtain water, the after crop is millet, or a species of bean from which soy is expressed. In some districts it is customary, after taking off a crop of cotton and indigo, to sow the ground with wheat, that it may be clear for rice by the month of June.

The Chinese reaping-sickle is said to be dentated like a saw. Neither carts nor cattle are employed to carry the sheaves from the field; but they are placed on bamboo frames, and conveyed to the threshing-floors on mens shoulders. The grain is separated from the straw by means of the common flail, by beating it against the edge of a plank, or the sides of a tub, and by the treading of oxen, methods of threshing which are practised in the open air. When the land is cleared of the crop, the stubble is rooted up. This is done with the hoe. One man advancing in a straight line strikes up a row on each side of him; he is followed by a second who gathers the stubble into heaps; and by a third who breaks up the soil for the reception of another crop. The stubble is burnt on the field, or is used as fuel in the houses.

In the southern provinces, the cotton shrub, the sugar cane, the mulberry tree, camellia sasanqua, and the tea plant, are extensively cultivated, together with wheat, rice, indigo, and tobacco. The cotton, like almost every thing else in China, is planted in rows. The shrub is but of a dwarfish growth; but it is well laden with pods, containing fine wool. It degenerates after the third year, when the ground is replenished with seedling plants.

As the Chinese are generally clothed in cotton, and as blue is the common colour of their clothes, an indigo plot is therefore an usual appendage of the cotton plantations. The sugar-cane is cultivated in those places which are at once warm and moist; and as this kind of soil is also suitable for the growth of rice, it is frequently planted between the rows of cane. The banks of some of the southern rivers, thus cultivated, are frequently many feet above the stream; in these cases the Chinese have an ingenious contrivance for raising the water to the plantations. This purpose is effected by means of a wheel constructed of bamboo, which is made at a trifling expense, requires no attendance, and, in the course of 24 hours, it will raise 100 tons of water to the height of 40 feet. Many plantations are irrigated in this manner.

Silk is the staple produce of the province of Tchekiang, and consequently a great part of the province is covered with groves of mulberry-trees, which are kept low, to force them to send out a constant succession of fresh leaves, on which the worms feed. Loud noises are fatal to these caterpillars; they are therefore kept in the middle of the plantations, in small houses built on purpose; and yet whole broods are sometimes destroyed by thunder. The *camellia sasanquá* of the botanists, the *cha-wha*, or tea-flower of the Chinese, is cultivated in vast abundance for the excellent oil expressed from the nuts which it yields. This elegant plant, which strikingly resembles the broad-leaved myrtle, and which, like the tea-shrub, bears a white-coloured flower of exquisite fragrance, thrives best on the sides and tops of mountains, where the soil consists of little more than fragments of stone crumbled into a sort of coarse earth, by the joint action of the sun and the rain. The tea-plant, whose fragrant leaves are now in such universal demand by all classes of people in Europe, is extensively cultivated throughout the southern side of the empire. Extensive tracts of hilly-ground in the provinces of Yun-nan, Quang-see, Quang-tong, and still more of Fo-kien, are covered with this beautiful and useful shrub. The numerous limber shoots from the root are in some places allowed to ascend to the height of six or eight feet, in other places they are cropt and kept low. The *tea* is sometimes planted as a hedge-row, and even in the plantations it is commonly disposed in straight lines. The leaves are plucked in spring, and twice afterwards in the course of the summer. The leaves of the youngest plants, those gathered in spring, and those of the second and third gatherings, which grow on the tenderest shoots and utmost twigs, are, from the fineness of their flavour, in the highest estimation, and on that account they are kept separate from the coarser kinds. The distinction of black and green teas, with the sub-distinction of them into sorts, such as bohea, congou, and souchong, hyson, bloom, and gunpowder, is supposed to arise from the same circumstance, together with the mode of drying the leaves. This, however, will not fully account for the difference; for, whether there be more than one species of the tea-plant or not, it is obvious that the qualities of its leaves must be sensibly affected by the nature of the soil and the temperature of the climate in which it grows, from the age of the plant and the size it is permitted to attain, as well as by the place of the plant from which they are taken, by the time of the year when they are plucked, and by the manner they are prepared for the market. The leaves are plucked, one by one, from the shrub, exposed to the steam of boiling-water, and then roasted on plates of metal, or baked earth; and yet, after these and other tedious, and withal expensive processes, the prime cost is said to be only from fourpence to two shillings per pound.

Gardening.—It would appear from these statements, that the style of cultivation prevalent in China is rather a species of horticulture than what is commonly understood by the term agriculture. By the general use of the spade, the rake, and the hoe, the Chinese are enabled to keep their country so remarkably clean of weeds,—to lay out plots of land for particular purposes with such elegant neatness,—and to render it so exceedingly productive, as to have forced from travellers the declaration, that the country, wherever it was capable of being cultivated, had the look of an immense garden. They cultivate an endless variety of fruit-trees, (among which are all the sorts common to Europe,) which they propagate by methods of their own. Of these the following is frequently practised: A bearing bough of a favourite tree is selected; a ring, an inch broad, of the bark, is cut off early in the season; a ball of mould is bound around the place, which is constantly kept moist; roots strike out into the mould, so that the branch becomes a tree, which, being separated from the parent-stock, and planted out in autumn, yields fruit the ensuing season. They have also a method of dwarfing forest-trees of the most gigantic growth, which, when thus diminished, are regarded as great ornaments to courts and private houses.

The imperial gardens of Yuen-min-yuen at Pekin, and of Ge-hol in Tartary, are described by Mr Barrow, and still more by Lord Macartney, in the glowing language of admiration and delight. The gardens of Yuen-min-yuen comprehend an area of ten square miles, broken into hill and dale,—diversified with wood and lawn,—traversed by rivers,—and interspersed with sheets of water, whose banks, although they are neither trimmed, nor sloped, nor shorn, are yet raised in a manner that represents the free hand of nature. The magnitude and tints of the trees seem to have been considered in the composition of the landscape, and are so arranged and grouped as to add greatly to the beauty of the scene. The gardens of Ge-hol, where the emperor has his summer-residence, are splendidly described by Lord Macartney, who says of them, "There is no beauty of distribution, no feature of amenity, no reach of fancy, which embellishes our pleasure-grounds in England, that is not to be found in this charming place. The situation of the ornamental buildings is peculiarly happy; they never obtrude on the eye, but whereever they appear they improve and enliven the prospect." The eastern side of the gardens possesses these attractions of softness and amenity; but the western side swells out into sublimer beauties. It is, says his Lordship, one of the finest forest scenes in the world—wild, woody, mountainous, and rocky, abounding with stags and deer of different species, and most of the other beasts of chase not dangerous to man. But these, with very few exceptions, are the only ornamental gardens in the empire. In travelling through the country, in the length and in the breadth thereof the eye is not feasted, nor the imagination regaled by the recurrence of any thing resembling the parks and the pleasure grounds of Europe; but, on the contrary, the oppressive languor of *ennui* steals over the mind from the boundless extent and the extreme sameness of the scene, which in naked uniformity stretches around on every side; and then the reality of the fanciful descriptions which Father Attiret and Sir William Chambers have obtruded on the public, is sought for in vain.

Fishing.—The fishing stations of China, equally numerous and important, are open, without tax or restriction, to the enterprize and industry of all who may choose thus to earn a livelihood. And with this view many thousands of families live entirely on the water, and ply their occupation throughout the year. The boats and rafts in which they dwell, are seen floating in every direction on the lakes and rivers. These fishermen have recourse to many methods for taking the fish;—they have nets set in every form, wicker baskets made exactly the same as those in Europe; boats with moveable planks turning on hinges, and painted so as to deceive the fish in moon-light, and to entice them to leap upon the planks. But the most peculiar, as well as the most common mode of fishing in China, is with the bird called Leu-tse, or fishing Corvorant (*pelicanus sinensis*), which, though not much larger than the common duck, will seize and hold fast a fish equal to itself in weight. The usual practice in this kind of fishing, is to take five or six pair of these birds fasting in the morning, on rafts, and to send them out by pairs for fish, which are taken from them the moment they bring them to the surface. The capture of aquatic birds is also an object with these fishermen. To this end they throw gourds and blocks of wood among the birds to serve as decoys, and then, with a gourd or something like it on their head, they wade unperceived among the birds, which they pull at their leisure into a bag under water. The pale, meagre looks of these people, shew that their condition is not much to be envied. Having no habitation on land, they raise onions and other vegetables on rafts of bamboo, well interwoven with reeds and strong grass, and covered with earth; and these floating gardens are towed after the boats. The women assist their husbands in all the operations of fishing; but the younger part of the family are employed in the breeding of ducks, of which there are frequently many hundreds in the same vessel. They are taught to obey the signal of a whistle, by which they know when to leap on the land, into the water, and back into the boats. The old ducks are left at liberty to lay; for their eggs are hatched by artificial heat, in boxes of sand, and on plates of iron. When grown, and in good condition, they are killed, split open, salted, and dried in the sun. Hogs are also bred in the boats, which, with the ducks and fish, are exchanged for rice and the other necessaries of life.

Appearance of the Chinese.—The physical characteristics of the inhabitants of China, are precisely the same with those of the Tartars and Malays. In height of stature they do not differ widely from Europeans; but the general form of their features is entirely peculiar. Corpulency is regarded a great beauty—a charm, however, which few of them possess, their bodies being remarkable for extreme tenuity, with very small joints. Yet most of them are well limbed, and many of them are muscular. The hair of their head is universally black and coarse, and will grow from their crown down to their heels. But the greatest peculiarity is exhibited in the features of the face; the head as it sits on the shoulders resembles an inverted cone; the complexion varies from the darkest brown to the brightest olive; the nose is flat and broad at the root, separating the eyes far asunder; the eye itself is the most singular feature of the whole; its position in the head is not horizontal but oblique, being depressed at the end next the nose, while at that next the ear it is sharp and pointed upward. Women are seldom seen, but such as shew themselves exhibit the same cast of features as the men. They have all the broad snub nose, high cheek bones, oblique eyes, and above all, long ears, which luckily for themselves are regarded as a great beauty. These harsh features, however, are in many of the ladies so softened and feminized, as to have obtained the praise of comeliness, even from British travellers, whose own fair countrywomen throw those of every other nation into the shade.

Food.—The ordinary bill of fare of the common people of China, is neither abundant nor various. It comprehends next to no milk or dairy produce, very little wheat bread or shambles meat, which, with potatoes, form the principal aliment of Europeans. This in China, on the other hand, consists mainly of *rice*. *Fan*, that is, boiled rice, enters into every compound that implies eating; breakfast is morning rice, supper is evening rice. Millet, barley, or buckwheat, however, is frequently used in its stead, which, as well as the rice, they eat along with onions, garlic, or a kind of cabbage fried in rancid oil. Animal food, though extremely scarce, is highly valued, and the poor bless their stars when they are able to obtain a relish of pork, duck, or fish. Dogs, cats, rats, and indeed carrion, vermin, and garbage of all kinds, are greedily devoured as rarities by this half famished race, who, it would seem, are always on the very verge of want. Weak tea, without sugar or milk, is the general beverage; and those who can afford it drink also beer and spirits made from rice. They eat generally squatted on their heels, around the pot in which their meals are cooked, with each a bowl in his hand to help himself withal.

But the rich in China are said, still more than in other places, to fare sumptuously every day. Fish, beef, mutton, pork, and poultry, are at their meals served up in great profusion. All kinds of game, high-seasoned soups, and rich jellies, are procured, at an enormous expence, by all those who think that human happiness consists in sensual indulgence. Hence gin-seng, birds nests, a species of fucus, sharks fins, bears paws, and the sinewy parts of many other animals, are carefully collected, at whatever cost, to compose these gelatinous viands. Bread, pastry, vegetables fresh and preserved, iced fruits, tea, and hot rice whisky, form also a part of their meals. At entertainments the guests eat and drink according to the motions of the master of the feast. Three or four only sit round the same table; the quantity of a man's mess is not proportioned to his stomach, but to his rank; whatever is left by the guests is sent home after them.

Dress.—The costume of either sex, and of all ranks of the Chinese, is essentially the same. Fishermen are sometimes seen literally naked, and multitudes wear nothing else except a pair of cotton drawers. The common people, however, are generally dressed in large straw hats, cotton frocks of various colours, wide cotton trowsers, and thick clumsy shoes made of straw. Those who affect finery, wear velvet caps on their heads, resembling Highland bonnets; short jackets with wide sleeves, made of cotton cloth or camblet, and of a black, blue, or brown colour, quilted petticoats, and black satin boots. On a back view, these habiliments give them the look of bulky old women, an impression which the universal use of fans serves to confirm, till, on confronting them, their clumsy boots and black beards forbid the interpretation. Their hair from the crown is suffered to grow long, and is plaited like the lash of a whip. This, generally speaking, is the dress of the emperor and of all his people.

The female frock reaches to the middle of the thigh, or to the knee, according to the taste of the wearer, under which red, green, or yellow trowsers descend, and are drawn tight below the calf of the leg. Their unshapely ancles and cramped feet, "are as fine as tinsel and tawdry can make them." They braid their hair and secure it with two bodkins of silver, brass, or iron placed behind, in the form of an oblique cross, and adorn it with bunches of artificial flowers. The eye-brow is formed into an arched line and stained black; the cheeks and neck are daubed with white paint; and a circular spot, of a deep vermilion colour, adorns the centre of the under lip, and the point of the chin. All the inhabitants of the south are clothed in silk, and seem, in other respects, from the fertility of the soil joined to their own industry, to be in more comfortable circumstances than those who dwell in the bleaker regions of the north. Here, most of the men are gaily dressed; and the ladies generally wear over a silk-netting a waistcoat, and drawers of silk, trimmed or lined with furs. Above this is worn a long satin robe, which is gracefully gathered round the waist, and confined with a sash. On the head they wear a black satin cap, from which a triangular peak descends over the brow to the root of the nose. These different part of their apparel are of such colours, and are so flowered and embroidered, as to suit the taste of their respective wearers. Long nails, both in men and women, are greatly admired; and consequently some of them are seen with nails of an enormous length.

Yet, with all this finery, the Chinese are a frowsy race; they seldom change the part of their dress next the skin, and never know the luxury of clean linen; and they seldom bathe their bodies, and they have no soap to wash their clothes; they blow their noses with their fingers, and squirt the saliva about the room. Hence a savour is diffused from the close packed crowds which curiosity sometimes draws together, which is by no means grateful to the olfactory organs of Europeans.

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Domestic habits.—The houses of the peasantry correspond in humility with the plainness of their food, and the simplicity of their dress. They are, in general, nothing more than mud hovels, thatched with straw or reeds, which, with a small area around them, are enclosed by a wall of clay, or a pallisade of stakes. The interior of these hovels is divided into two apartments, by a curtain of matting suspended from the roof; each of these divisions has a hole to admit the light, but one door serves for both. A pillow, made of a block of wood, or a bundle of bamboos, a felt rug, formed from the hairy wool of the broad-tailed sheep, and a mattress stuffed with wool, hair, or straw, constitute their bedding. Two or three jars, a few basons of earthen ware, a large iron pot, a frying-pan, and a portable stove, are the chief articles of their household furniture. As they, like other Asiatics, sit upon their heels, chairs and tables are not required. The walls of the houses, as well as those which enclose the court in which they stand, are sometimes of wood, brick, or stone; but, with all the other buildings of the country, they have uniformly a tent-like appearance. Their leisure hours are spent in smoking tobacco, chewing betel, or opium, and in playing at games of skill or chance. The former is generally a kind of chess, peculiar to themselves; and for the latter they have cards and dice. They have also a game which they play with their fingers, in which two persons sitting opposite to each other hold up their hands at the same moment, and call out what each guesses the number of extended fingers of both to be. Quails and grasshoppers are trained by them to fight and kill each other, as cocks with us are too frequently bred for the same barbarous purpose, in which fools and bad men find amusement. They are strangers to the joys of social intercourse; the young have no assemblies for dancing or meetings for festivity; there are no fairs in the cities, nor congregations in the temples; athletic exercises, and active amusements, are entirely unknown. There are tea-houses, and cook's shops in all places of the country, but they are not resorted to for the sake of society, but merely for refreshment, by tradesmen and the peasantry, with the inferior officers of state.

Female degradation.—These solitary manners of the Chinese have generally been attributed to the careful seclusion of their women. According to their maxims, it is not only shameful, but morally wrong, for females of the upper orders to be seen mingling with men in public. Even the boys and girls of the same family are kept separate, almost from their infancy. The wives and daughters of the poor are, indeed, exempted from such unnatural confinement, but this liberty is dearly bought by their abject and unremitting drudgery. In the country, they are seen assisting their husbands, fathers, and brothers in the most laborious operations of husbandry,—even that of drawing the plough, yoked along with an ass. In the towns, all women of lower and middling rank are employed in spinning, weaving, and embroidering both cotton and silk. The ladies of the rich and the great live in idleness and apathy; and when they have occasion to visit their neighbours or friends, they are carefully covered up in sedan chairs, or in a kind of wheelbarrow with a concealed seat.

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Cramped feet.—Whether this Chinese custom of female seclusion had its origin in jealousy, or be the offspring of superstition, is uncertain; but especial care has been taken, by the general prevalence of another custom, the cause of which is also unknown, to render its violation next to physically impossible. The feet of female children are compressed with bandages, so as to restrain their growth, and to prevent them from ever attaining their natural size. The toes are folded under the sole, and the heel is obliterated by the use of these bandages, so that the foot never reaches beyond the length of four or five inches; but the ancle in general swells in proportion as the foot diminishes. As the influence of fashion has made these distorted feet be regarded as the standard of gracefulness and gentility, much care is bestowed by the ladies in dressing, adorning, and showing them off to advantage. As this absurd and cruel custom is not even alluded to by the earliest European travellers in the country, it has been conjectured to be of comparatively recent origin; no satisfactory account, however, has hitherto been given, either of the time when it became current, or of the reason of its adoption.

Marriages.—It is clear, from these statements, that neither the anxious suspense of a protracted courtship, nor the endearing delights of mutual love, can ever precede the formation of a matrimonial union in China. The bride, indeed, is never once consulted on the subject. She is purchased from her parents, and becomes, of course, the property of him who pays the highest price. But even the bridegroom has no means of judging of his bargain, except from the second hand description of her friends. He must take their testimony of the lady's beauty, talents, and accomplishments. When the nuptial day arrives, the bride is placed in a chair, the door of which is locked, and the key entrusted to a confidential servant, and attended by a pompous train, carrying torches, and beating drums and gongs, she proceeds in formal procession to the house of her spouse. On her arrival at his gate, he is presented with the key of the chair, the door of which he opens, and looks on his love for the first time in his life. If he likes his bargain, she is conducted into his house, and becomes its mistress. If he does not like her, he instantly returns her to her parents. But on this event the original purchase-money is forfeited, and an additional sum, equal to the amount of the first, may be demanded. As the extinction of a Chinese family is regarded as a grievous calamity, because in that case the sacrifices in the temples of a long line of ancestors must forever cease, marriages are greatly encouraged, and are universally contracted. A father lives in dishonour unless he marry off his children. And as children in China are bound by the laws to maintain their parents, it is with the poor a prudent measure to have them married in good time. With the view, therefore of providing cheap wives for their sons, they sometimes go to the *foundling hospitals*, and there obtain girls, whom they rear in their own houses till they are at a proper age. When rich families happen to be childless, they adopt orphans as their heirs and representatives. On the same principles polygamy is permitted. The condition of concubines is subordinate to the legitimate wife, and their children are taught to regard her as their mother. Marriages which have been duly solemnized, must not be dissolved on slight grounds. The legal causes of divorce are adultery, barrenness, infectious diseases, jealousy, and antipathy of tempers.

Infanticide.—The super-abundant population, and the consequent pressure of poverty resulting from the early marriages so universally prevalent in China, exert, in many instances, an influence so overpowering and imperious, as to drive parents to the terrible expedient of exposing their own offspring to inevitable destruction. There is, indeed, no law to authorise this unnatural and cruel custom, but government seems to think it more expedient to connive at its daily practice, than to interfere with the great principles of parental jurisdiction and filial obedience, from which the principal part of its power is derived. Mr Barrow says 24 infants are, on an average, exposed to perish nightly in the streets of Pekin, which gives nearly 9000 in the course of the year for that single city; if, therefore, the destruction of human life effected by this means be in the same proportion throughout the empire, it is indeed shockingly enormous. But as all infants that die a natural death, or that are still-born, are, by the poor, exposed in the streets, or thrown into the rivers, the murders may not be so manifold as the number of bodies exposed would lead us to conclude. To clear the streets of this dreadful nuisance, carts appointed by the police go their rounds through them at an early hour, and collect all the bodies of the hapless victims which have been exposed during the night, and carry them to a pit without the walls, into which, whether dead or alive, they are indiscriminately thrown. When it is recollected that dogs and swine are suffered to roam at large through the streets in which these scenes are transacting, it is easy to imagine how their natural horrors will often be aggravated.

Public works.—The Chinese are not more distinguished by the singularity of their domestic manners, than by the magnitude of the national monuments raised by their enterprise and industry. The country is intersected by numerous canals; the cities are surrounded by lofty walls; temples, bridges, and triumphal arches adorn all the provinces; and, to crown the whole, a stupendous wall, 1500 miles in length, runs along the northern confines of the country. The *imperial canal* is justly entitled, from its utility, to be regarded as the greatest of all the public works of China: It extends from north to south about 500 miles across the country, intersects the principal rivers at right angles, and intercepts the smaller streams, by which it is kept constantly full of water. Though the horizontal surface of the country through which it has been carried has in no small degree facilitated the accomplishment of this magnificent enterprise; yet, to accommodate the level to the inequalities which occur at different points in the progress of so great a distance, must have required a high degree of skill and a prodigious quantity of labour; for, in some places, this grand aqueduct is carried across a tract abounding with lakes and swamps, by means of gigantic embankments, between which the water is forced up to the height required by the general level; and, with the same view, its channel, in other places, has been excavated to the depth of 70 feet below the surface of the adjacent country. The course of this canal is not impeded by locks or obstructions of any kind, except flood-gates formed by planks made to slide in grooves cut in stone abutments, which, at these places, contract the channel to the width of 30 feet. By the same contrivance, the water in the canal is kept in constant motion; for, by raising or lowering the flood-gates, the surface of the canal is elevated or depressed, and a stream is made to set, at pleasure, either towards the south or the north. As the imperial canal is connected with all those rivers which flow from the mountains of Tartary, and which traverse the whole extent of China, and as it sends off numerous branches in every direction through the country, and at every point of its progress, it opens a communication with the remotest parts of the provinces, and forms the centre of the internal navigation of the empire.

Over this grand trunk, as well as over its manifold ramifications, are numerous bridges, with from one to seven arches, some of which are sharp-pointed, others semi-circular, and others curved like a horse-shoe; the piers, also, of some of them are so high, that vessels of 200 hundred tons burden sail under them without striking their masts. On the balustrades of these bridges are seen grotesque images of ideal beings, and monstrous distortions of nature.

But the great northern wall which divides China from Tartary is still more stupendous, (though not now so important) than even the imperial canal. This prodigious mass of masonry is extended to the distance of 1500 miles, overtopping the loftiest mountains, traversing the deepest vallies, and crossing, on arches, the largest rivers which intervene in the long line of its direction, in many parts of which it is doubled and tripled, so as to take in and defend important passes. The foundation of this wall is of stone, on which a mound of earth is imposed, which is cased on each side by a wall of solid and well-jointed masonry. It is studded throughout the whole of its extent by forts, which project from the wall at the distance of a bow-shot, or from 70 to 100 yards. It has been calculated, that the materials employed in rearing this immense pile, would be sufficient to surround the circumference of the earth on two of its great circles, with a wall on each six feet in height and three in thickness. The original intention of this stupendous bulwark was to protect the northern frontier against the incursion of the Tartars; but now that the regions on both sides of it are united under one head, it is no longer garrisoned or kept in a state of repair.

Cities.—The population of China, more than that of most other countries, is collected into immense masses,—a mode of living which seems to have originated in the same feelings and motives that led to the erection of the great northern wall; for the cities, villages, and even the single houses of the country are inclosed and barricaded, evidently with the view of warding off wild beasts, or more wild and savage men. Upwards of 10,000 cities are scattered over this country, which are divided into three orders, according to their respective importance, and the extent of their jurisdiction. A city of the first order is called *Foo;* of the second *Tcheou;* of the third *Hien;* and a city having one or other of these words subjoined to its proper name, can thereby easily be referred to its rank in the scale. The plan of the cities of China is so extremely similar, that the description of one is sufficient to suggest an idea of all the rest. They are all built on quadrangular areas, which generally comprehend a good deal of garden ground. They are all surrounded by walls, flanked with towers at regular intervals, raised higher than the houses which they inclose, and encompassed with a ditch or moat. The main streets extend from wall to wall, and terminate in gateways through them into the country. These gates are surmounted by square buildings, sometimes of several stories, with large projecting roofs, and furnished with port-holes. At the intersection of the principal streets are seen those edifices which have been denominated triumphal arches, but which are, in truth, monuments to the memory of meritorious individuals. They consist merely of a large gateway, with a smaller one on either side of it; they are covered with narrow roofs, and, like the houses, they are varnished and gilt in the most splendid manner. Tall temples and pagodas, of from three to nine stories high, each of which has its own projecting roof, present themselves to notice in various situations; and a vast assemblage of one-story high houses, arranged in straight lines, but all standing detached, without windows except to the front, completes the general description of a Chinese city, which, to a European, suggests the idea of a large encampment, rather than a collection of permanent habitations.

Pekin.—Pekin, or Pe-ching, the northern court, is now the metropolis of the empire, and contains the principal palace, and the public councils and state tribunals. The walls, which inclose an area of about 12 square miles of an oblong form, are constructed on the same principles observed in the erection of the great northern barrier. They are composed of a stone base about 25 feet in thickness, of an embankment of clay dug out of the surrounding ditch, sloping upwards to the height of 40 feet, and faced within and without with bricks or stone. Forts occur all around them at the distance of a bow-shot, or between 60 and 70 yards from each other. Through these walls the city communicates with the surrounding country by means of nine gates, the south wall having three, and each of the others two. All these gates are surmounted by elevated watch-towers, more in appearance for defence than in reality; for though they are furnished with port-holes, they are shut up with doors on which the figures of cannon are painted, while the interior parts are generally employed as granaries. At each gate an extensive suburbs exhibits a busy scene of shops and manufactories, with crowds of people passing and repassing in unceasing succession. The area within the walls is divided into two parts, one of which constitutes what is denominated the Chinese city, and the other what has received the name of the Tartar city, from the circumstance of their being inhabited respectively by natives of these countries. The imperial palace is situated in the Tartar city; and is itself equivalent to many cities of note, being about a mile square, surrounded with a wall of polished bricks 20 feet in height. Part of the space within this inclosure is occupied with the accommodations of the emperor, of the ministers of the court, and of the different offices of the government; and the rest is highly ornamented with canals, basons, lakes, and streams, intermixed with gardens filled with artificial mounts, rocks, and groves, exhibiting the happiest imitations of nature.

The main streets of the city are extended four miles in length and about 120 feet in width between the opposite gates, except one, which is interrupted in its progress from east to west by the site of the imperial palace, which it is therefore made to encompass. Numerous cross-streets or lanes branch off at right angles from all those which pass between the gates; and in these cross lanes the rich and the great have their habitations. The houses are generally only one story high; stand for the most part detached from each other, and frequently obliquely to the line of the street along which they are ranged. The buildings which front the great streets consist entirely of shops and warehouses, at the doors of which the goods on sale are alluringly displayed. A colonnade of wooden pillars runs the whole length of the streets, and rises above the roofs of the houses, on which are inscribed the name and good character of the different traders, and descriptions of the nature and excellence of the articles in which they deal; and which flow from top to bottom with streamers and ribbons of various colours. The shops are also generally furnished in front with balconies filled with flowers and dwarf trees tastefully arranged, and are brilliantly painted over with blue and green, mixed with gold. These public streets, in the whole of their breadth, and from the one end to the other, are full of bustle and confusion. Tea and fruit, rice, and other eatables, are there exposed to sale in tents and booths; tinkers and barbers, coblers and blacksmiths, there ply their respective crafts in moveable shops; pedlars with their packs, jugglers, and conjurers, and fortune-tellers, mountebanks and quack-doctors, comedians and musicians, are there in eager competition for public favour; marriage and funeral-processions meeting and mingling; troops of dromedaries, laden with coals from Tartary; wheel-barrows and hand-carts stuffed with vegetables; with an immense concourse of people passing and repassing from one place to another, buying, selling, and bartering their various wares; and an incessant buz of confused and stunning noises,—are scenes daily exhibited in the streets of this celebrated city. When a novelty happens to occur, a crowd is collected, not merely to gaze at the spectacle, whatever it may be, but every one, while he gratifies his curiosity, pursues his proper business. Neither this, nor any of the other cities of China, is furnished with common sewers; but the streets are kept free from filth, by every family collecting what is produced within its own precincts, in large earthen jars, and exchanging it with the gardeners for vegetables and pot-herbs. Pekin is said to contain about 3,000,000 of inhabitants, and is situated near the 40° of north latitude, and between the 116° and 117° of east longitude.

Nan-kin, the capital of the province of Kiang-nan, was once the residence of the emperor, as its name, which signifies *southern court*, still indicates. The site of the city is broken by mountains, and is inclosed by walls five leagues and a half in compass, which, if the statements of the Chinese themselves be true, was once four or five times that extent. About a league to the north of the city, the great river, Yang-tse-kiang, rolls his mighty streams; and the surrounding country, which is picturesque and fertile in the highest degree, is intersected by numerous canals. Since the Tartar conquest, and the removal of the imperial court, Nankin has fallen from its former magnificence. Its ancient observatory, and its stately temples, now mouldering in ruins, and a third part of the city itself abandoned to desolation, exhibit the melancholy monuments of a departed glory. Still, however, the gates of the city are entire; and some of its ancient edifices, among which is the porcelain tower, 200 feet in height, divided into nine stories, which rise on the arches sustaining the roofs, remain to give it an air of grandeur. The streets of the city are narrow, but well paved. Nankin excels in the manufactures of satin stuffs and woollen cloths; of artificial flowers; of paper, ink, and the printing of books; and is also the most literary and scientific city in the empire.

The jealous system of exclusion, so rigorously exercised by the Chinese towards strangers, has hitherto kept us in profound darkness in regard to the extent, the police, the trade, &c. of the great majority of their cities, as well as in regard to a multitude of other facts, necessary fully to develope the physical and moral condition of the country. The interior of most of their cities has never been seen by Europeans; and even such as have been permitted to enter, have had few opportunities of examining them with accuracy. A few detached and transient notices of what fell under their observation in their way to the capital, and thence across the country by the route of the imperial canal, is all the information which even the intelligent gentlemen who composed the train of both the recent British embassies have had it in their power to impart to the public.

The city Tien-sing is built at the union of the Pei-ho and Yun-leang-ho, or grain-bearing river, about 100 miles below Pekin, and stretches, like London, for several miles on both sides of the river. Along the quays are temples, shops, and warehouses; and the houses, built of leaden coloured bricks, arise like an amphitheatre on the sloping banks. The population is estimated at 700,000 souls; and as the city is the great emporium for the northern provinces, the river is literally covered with junks of various sizes, and the bustle on shore is excessively great. One of the most remarkable things observed in the neighbourhood of this city, is an immense quantity of salt stowed in bags, and piled in pyramids of 15 feet in height. Mr Barrow calculated the aggregate weight of these stacks of salt to amount to at least six hundred millions of pounds.

Ton-choo-foo stands about 90 miles higher up the river Pei-ho, and within 12 of Pekin. The walls are substantially built, rise higher than the houses, and are washed by the river on one side, and encompassed on the three other sides by a broad ditch. The principal streets are straight, and paved with flagstones. This city contains a large pile of brick buildings, eleven stories in height, now considerably dilapidated and overgrown with weeds and shrubs; this mass, the lower part of which is entirely solid, without even an aperture, is supposed originally to have been a watch-tower.

Lin-sin-choo, though a city of the second order, acquires importance from being built at the northern extremity of the imperial canal, at which place it joins the Yun-leang-ho, the grain-bearing river, called also the Eu-ho, the precious river. The city is adorned with a temple, and is a place of great trade.

From Lin-sin-choo the canal extends 500 miles towards the south, and terminates in a great basin at the city Han-choo-foo. Its course in this long distance is studded by numerous cities and villages, of which Son-choo-foo is the most considerable. It is built in the province of Kiang-nan, at no great distance from *Nankin*, and is very large and populous. The streets, like those of Venice, are divided by canals; the houses are well built, and handsomely decorated. The beauty of the country in the vicinity is enhanced by the lake Tai-hoo, surrounded by a chain of picturesque hills, the great resort of parties of pleasure. The inhabitants, who are mostly clothed in silk, appear cheerful and prosperous; and the women are handsomer, fairer, and dress in better taste than more to the north. Travellers have termed this city the paradise of China; and the natives themselves say, in their own extravagant manner, that *heaven is above, but they have Son-choo-foo on the earth.*

Han-choo-foo, situated at the southern extremity of the canal, is the capital of the province of Tche-kiang. On the one side it has the great basin at the end of the canal, and on the other the river Chen-tang-chang, which falls into the sea 60 miles to the east. Numerous channels communicate between the canal and the river. The walls of the city, six leagues in circuit, built partly of hewn-stone and partly of brick, are very ancient and ruinous. The streets are narrow and paved, the houses are low, and constructed of brick; the chief streets consist entirely of shops, and have a rich and splendid appearance. The population is immense, not much inferior, as is supposed, to that of Pekin. Vast numbers of females are employed in the different branches of the manufacture of silk. This city is the emporium for all goods which pass between the northern and the southern provinces. But Canton, of all the cities of China, is the most interesting to Europeans, as there all the foreign trade is transacted. A description of this city will be found in its proper place.

Manufactures.—The Chinese have carried the manufacture of cloth, paper, and porcelain, to a high degree of perfection, and they excel in some of the mechanical arts. The silk-stuffs of Tche-kiang, and indeed of all the southern provinces, are distinguished for their fineness and variety. Their gauzes, both plain and flowered, possess a great deal of beauty; and their taffeties, satins, and velvets are of every possible fabric and colours. The manufactures of cotton and linen have all attained an equal degree of

China.

eminence. The cotton stuff, well known by the name of nankin, so called because manufactured originally in the city of that name, is made from a peculiar sort of cotton. Vast multitudes of the people are employed in the different branches of these manufactures, as the Chinese have little or no machinery to facilitate their operations. A great deal of paper is also made in this country, chiefly from the fibres and bark of the bamboo. The Chinese have also long been famous for their ink, formed into solid cakes, made by peculiar processes of a mixture of lamp-black and oil.

But this people are still more celebrated for their porcelain than for any of their other manufactures. They employ for that purpose a fine kind of clay obtained from decomposed granite, ground down, and well washed. Every piece, previously to its being put into the oven, is placed on an earthen box; and yet, with all their experience, the baking is in a great degree the work of chance; for frequently a whole oven runs into a mass of vitrified matter. Though the component parts of the materials from which they form their porcelain be essentially the same employed in the manufactures of England, the whiteness, hardness, and transparency of the Chinese biscuit still continues far superior to that of the English. But they are surpassed by the English in the elegant shape of the vases, &c. and the proportion and tastefulness of the ornaments. Yet they can imitate a pattern with the utmost exactness, and their colours are extremely beautiful. The potteries of porcelain, and of the other kinds of earthen-ware, are chiefly in Kiang-see, for the sake of coals. Kin-te-chin, a village of that province, is said to contain a million of people, all employed in this branch of industry. When it is dark, the furnaces of the ovens assume the tremendous appearance of a town on fire. The bamboo, in its entire state, split into laths, divided into fibres, twisted into cordage, or macerated into a pulp, is applied to an endless variety of useful purposes. Chairs, tables, and all other articles of household furniture, are formed from it. It is the material of which most of the implements of husbandry are made. It is used on board ships for poles, sails, ropes, and rigging. It adorns the palace of the prince, and it covers the cottage of the peasant. Its young shoots furnish an article of food; and it is the instrument in the hand of power to keep the empire in awe. In the cutting of ivory into fans, and into a great variety of ornaments, and in the large size and extreme transparency of their horn-lanterns they far out-do the artists of Europe. In silver filligree they are not inferior to the Hindoos; and in lacquered goods they are excelled only by the Japanese. They work in metals with great skill and neatness, and well understand the proper proportion of alloy for different purposes. They have the art of extracting from the animal, vegetable, and mineral kingdoms the most exquisite colours, and of imparting them again to the works of their own hands in whatever tints they please. Their tools are very simple, and contrived to serve more purposes than one. Thus, the barber's basket holds his apparatus, and furnishes a seat to his customers; the joiner uses his rule as a walking-stick, and the chest that holds his tools serves him for a bench to work on.

Commerce.—No country in the world has so much internal trade, and so little external commerce in proportion, as China. Her mineral riches, and her vegetable profusion, with the skill and industry of her people in collecting, raising, and preparing them to supply the wants of life, and to minister to the refinements of luxury, give her the full command of almost every thing necessary for existence, or desirable for enjoyment. All, therefore, that she requires, either for abundance or comfort, is the mutual intercourse of her people, and the free interchange of her commodities. And this she is careful to encourage; and for its attainment, her rivers and canals, navigable in every direction, and to the remotest parts of the empire, afford every facility. The vessels employed in carrying grain, salt, manure, fuel, manufactures, &c. from province to province, in collecting and carrying the revenues to the public magazines, and in conveying the copper currency from one place to another, together with those employed in the fisheries and in foreign commerce, are supposed to exceed, both in number and tonnage, the whole floating craft of the rest of the world. The whole of this home-trade consists in a barter of commodities. "For there is no system of credit established between the merchants of distant provinces; no bills of exchange; no circulating medium of any kind, except a small copper coin."

The intercourse of this people with their Asiatic neighbours is confined to Japan, Cochin-China, Java, Borneo, and the other islands of the eastern ocean, in many of which colonies of Chinese have established themselves, and adhere rigidly to the customs of their country. The chief articles of export are drugs, silk-stuffs, sandal-wood, hides, cloth, sugar, tea; and those of import are, pearls, gold, and copper, and other metals; sword-blades, and varnished goods; birds-nests, sea-slugs, sharks-fins, resin, amber, camphor, wax, tortoise-shells, ivory, &c. They sail for Japan in the month of May or June, and return in October, availing themselves of the regular monsoons; and for the same reason they do not sail for Batavia, nor the islands which lie south and west of them, till the latter end of the year. The carrying, both of these exports and imports, is entirely engrossed by the Chinese themselves. In an extent of coast of more than two thousand miles, indented with numerous, safe, and spacious harbours, studded with towns, and swarming with inhabitants, not a foreign ship is to be seen, except in the port of Canton, and occasionally a few junks from Japan and Cochin-China, in some of those of Fokien.

Canton is the only Chinese port which is open to European or American merchants. On the part of the Chinese, this foreign trade is entirely entrusted to a body of men known by the name of *Hong merchants*, an appellation derived from the foreign factories or warehouses—large buildings with square courts in front, arranged along the river, and called *Hong* by the natives. When a ship arrives in the river, she must not approach within fifteen miles of

Canton, and is instantly consigned over to one of these Hong merchants, who is security to his country for her conduct. The factory of the East India Company consists of twelve supercargoes, eight writers, a surgeon and assistant, with a tea-inspector and his deputy. The three senior supercargoes form what is called the select committee, all of whom have large salaries, and sumptuous tables supplied at the Company's expence. About 18 or 20,000 tons of shipping are engaged in this trade, which employs 2000 sailors, adds nearly four millions to the revenue of England, enriches the merchants, and furnishes an article of general consumption which no other country can supply. The English transact the whole of their business with the Hong merchants, and between both parties a high degree of confidence subsists, each taking the goods of the other according to their respective invoices. The East India Company export cloths, camblets, furs, metals, &c. to the amount of a million and a half sterling annually. And the captains and officers of their ships have the privilege of taking out petty cutlery, clocks, watches, coral, prints, and paintings, to the amount of about L.200,000. Tea, silk, and nankeen, are the principal articles of import from China. The annual importation of tea alone is about 30 millions of pounds weight. But provided it could be supplied at a cheaper rate, three or four times the quantity might be consumed in the united kingdom, to say nothing of the other nations of Europe, or of the British colonies. Besides the Company's trade directly between England and China, a good deal is also carried on between the latter and the Indian presidencies, especially that of Bombay. Cotton is the principal article of export from India, along with which considerable quantities of pepper, betel nut, pearls, sandal wood, &c. are stowed in the same ships; and the Chinese imports find a ready market along the shores of the Persian and Arabian gulfs, and the northern ports of Guzzerat. The capital employed in this branch of trade is about two millions and a half sterling.—*Barrow, Ellis.*

The American commerce with China is said to amount to two-thirds of that of the English—12,000 tonnage of shipping being employed in it. The Americans export seal-skins, furs, ginseng, and bullion, which they exchange for tea and other marketable articles. They transact as little business as possible with the Hong merchants, but repair to the open market for the bulk of their cargoes. Instead of an expensive factory, their affairs in China are managed by a single consul, who has no official concern in political matters. The whole system is managed on a plan so economical, as to enable the retailer of tea in America to afford to sell bohea at 1s. 6d. per pound, which in England costs 6s.—*Edinburgh Review, No. 58.*

The Russians also carry on an extensive commerce with China; it consists chiefly of an exchange of tea and silk, for furs. This intercourse commenced in the 17th century, when the Russian and Siberian merchants sent a *caravan* to Pekin; but these foreigners, after a good deal of negociation, were excluded from the *celestial city*, and are now retricted to Hiackta; and the intercourse of the Chinese with them is regulated by special direction of the government itself, through the medium of merchants appointed under the seal of the emperor. Some years ago the Russians procured a copy of the instructions of these merchants, which, while it shews the opinions of the Chinese in regard to foreign commerce, exhibits a full exposure of their mean and systematic fraud. This document consists of a great number of distinct heads or articles, which set forth—that all letters from Russia to their agents, are to be opened and read in a public assembly of the Chinese merchants, that they may act in concert against the Russians—that care must be taken to ascertain what articles are wanted, and the prices they fetch in Russia—that the Chinese market is to be kept scantily supplied, and no eagerness shewn in the purchase of Russian goods—that when the Russians happen to have a scanty supply of any article, it is to be bought up at a price to induce them to bring it in such abundance as will enable them at last to obtain it far below its value. This document farther instructs the merchants to tell the Russians that China does not produce silk and cotton—that they must be careful to learn the Russian language, and to prevent the Russians from learning that of China—that in all their intercourse with the foreigners, they must be careful to increase their knowledge of the affairs of Russia, but information of every kind is to be studiously withheld from them. The violation of these or of any of the other instructions contained in this paper, subjects the delinquent to a gradation of punishment, from a reprimand to death.

Government.—China, in its political aspect, exhibits the most ancient, the most extensive, and withal the purest system of despotism, that has ever perhaps existed in the world. The whole apparatus by which such a vast mass of mankind is kept in order and in awe, is set in motion by one single principle, that of *filial obedience*, carefully inculcated from time immemorial. Amid the lapse of generations, and the vicissitudes incident to human affairs, this patriarchal power, the main spring of the Chinese government, has not merely maintained the ascendency, but has actually acquired additional vigour, and a deeper degree of veneration; so that, at this moment, the authority of the Emperor is absolute and without controul. As sovereign of the empire, he is *the son of heaven, and the parent of his people.* His subjects of every rank and degree are supposed to stand in the same relation to him that he does to the Deity,—monarchs, and kings, and princes, all the possessors of power, by whatever name they are known, are his vassals: *For heaven has not two sons, the earth has not two masters—there is but one God in heaven, and one emperor on earth.*

Arrogant as these assumptions are, they are, nevertheless, in so far as the possession of absolute power is concerned, substantially true. No law restrains the will of the Emperor of China. He can make new laws and abrogate the old; the lives and property of all his subjects are in his hand and at his disposal; the slightest and the severest punishments are inflicted in his name, and, if capital, never without his consent. It is his prerogative to invest with honour and with office, and to deprive of power and cover with disgrace. In a word, he rules with the same authority over all the people of the empire, that the father of a family exerts over his offspring. And as this great father is placed above all earthly control, so he is also regarded to be above earthly descent. But even in this state of supreme pre-eminence, he is careful to inculcate the great principle of *filial obedience*,—the firm rock on which the fabric of his power is reared,—by his personal example. Always, at the commencement of the new year, this *sole ruler of the world; and only son of Heaven*, performs his nine prost rations before the Empress-dowager; and then in his turn, he himself receives the same homage from his courtiers; and they again exact a similar obeisance from all who are under their authority; so that this great principle of Chinese authority is constantly recognised and acted upon, from the Emperor's palace to the fisherman's raft.

But, while the people are thus taught to look towards the throne with feelings of awe and veneration,—with the prostration of the soul as well as of the body—care is taken that they should love the person as well as fear the power of the Emperor, who, to all intents and purposes, is the *Lord their God.* They are taught to regard all the blessings of life as the emanations of his goodness,—that his compassion extends, with parental tenderness, towards every individual of his children,—that in times of calamity, difficulty, and danger, he fasts, and prays, and sacrifices to heaven for them all. This exorbitant power is, however, in some degree counterbalanced by veneration for ancient usages, generally known, and constantly appealed to; and by the registry of all the Emperor's words and actions, by public officers, who in virtue of ancient usage, are appointed to watch over him, and to record the particulars of his conduct in full detail for the instruction of posterity. And though the public voice is never heard in the determination of any public measure, yet public opinion is sedulously courted by the sovereign, and conveyed to every part of the empire through the medium of the *Pekin Gazette*. This state paper is published daily, is sent into all the provinces, and read in all the taverns and tea-houses of the country. Through it all the measures of the government, or rather of the Emperor, are communicated to the public. If he fasts, or feasts, promotes or degrades, levies or remits taxes, feeds the hungry, clothes the naked, rewards virtue, or punishes vice, it is carefully noted in this imperial paper. Every sentence of death, with an abstract of the charges and the trial, every pardon of offence and mitigation of punishment, with the motives and the reasons that may have given rise to them, are all announced in this powerful engine of state, which, if a series of it could be obtained, would explain the nature of government better than all the moral maxims of antiquity on which it is supposed to be founded.

Emperor's household.—This mighty man is attended by crowds of eunuchs, and spends the most of his leisure time among the women of the palace. He can have only one Empress, but is not restricted in the number of his queens and concubines. These women must reside forever within the precincts of the royal residence; and after the Emperor's death they are immured in what is called the palace of chastity. The daughters of the Emperor are generally given in marriage to the Tartar Princes, who, in consequence of this imperial relationship, engross the highest and most honourable offices. The princes of the blood have their names, with the date of their birth, registered in the *yellow book*, and have the privilege of wearing the *yellow girdle*. But those of them who are removed from the direct line of the reigning Prince, are registered in the *red book*, and wear the *Red Girdle*, and in a few generations fall back into the mass of the people. The court is composed of the princes of the blood and the mandarins in office,—forming a numerous train of attendance, moulded, by a constant attention to ceremony, into the exactest order. The Emperor and his family wear vestments of yellow silk, on which frightful dragons are profusely embroidered. The robes of the mandarins are of a violet colour, and are often enriched with golden embroidery. These courtiers, who live in solitary cells, and eat their rices and stews with chopsticks, exhibit a splendid appearance on public occasions. Their robes of silk, brilliant with embroidery; their silent solemnity; their order and decorum; with the accompaniment of deep toned and loud sounding music, present to strangers an impressive spectacle.

Mandarins.—The civil and the military officers of state are distinguished by the name of mandarins, of whom there are nine orders of co-ordinate rank; each of which is at once pointed out by a distinctive badge. Those of the first order wear a *ruby transparent button* in their bonnet; the figure of a pelican, or of a fabulous animal on the back and front of their robes; and four agate stones in their girdles. The second order have a red *opaque button*, with the figure of a hen or a lion on their robes, and squares wrought with gold and set with rubies in their girdles. The third order have a blue transparent sapphire in their bonnet, the figure of a peacock, or of a panther, with a golden wrought girdle. The fourth order have an opaque blue button, the figure of a crane or tiger, with a golden wrought girdle. The fifth order have a transparent white button of rock crystal, the figure of a white pheasant, or of a bear, with four squares of gold on the girdle. The sixth order are distinguished by an opaque white button of a marine shell, with the figure of a stork, and with plates of shell on the girdle. The seventh order have a small crystal button, the figure of a partridge, or a rhinoceros, with silver plates on the girdle. The eight order have a button of wrought gold, the figure of a quail, and four plates of ram's horn, with a silver button on the girdle. The ninth order have a button of wrought gold, the figure of a sparrow or of a sea-horse, with plates of ram's horn on the girdle.

Administration.—These mandarins assist the Emperor in the weighty affairs of state, and in the arduous task of governing an empire of such vast extent, and of such immense population. For the administration of the affairs of government, there are six boards or departments, consisting of—1st, The court of appointments to vacancies in the offices of government, being composed of the minister and learned men, qualified to judge of the merits of candidates; 2d, The court of finance; 3d, The court of ceremonies, pre-

China. siding over the directions of ancient customs, and treating with foreign embassadors; 4th, The court for regulating military affairs; 5th, The tribunal of justice; 6th, The board of public works.

These public functionaries sit at Pekin, and resolve upon, recommend, and report to the Emperor, all matters belonging to their separate jurisdictions. In each of the six boards there is a *Censor*, who, like our speaker in the house of Commons, sits as president, refers to precedents, and keeps order. These six Censors, or Co-taos, as they are called, are supposed to be in the interest of the Emperor, and form an extraordinary board, which has the power of dispatching visitors, or subcensors to all parts of the empire, to watch over the conduct of the public officers, to discover abuses, and to send their information to the court. Each of the six boards also sends out its appropriate officers, with whom it maintains a constant correspondence; abstracts of which, and of the proceedings of the court, are daily laid before the Emperor by one of the Co-loos or principal ministers. Besides the ordinary council of the Emperor, consisting of the Co-taos, there is also an extraordinary one, composed entirely of the princes of the blood, whose business is to preside over the affairs of the imperial household, and occasionally to deliberate and advise along with the ordinary council.

All the officers of government are restricted by numerous limitations, all of which imply the most anxious suspicion. The duration of an appointment never extends beyond the period of three years; no man can hold an employment in a city or district where he has relations; he can neither marry a wife, nor purchase lands within the bounds of his jurisdiction; if his father or mother should die during his magistracy, he must resign his appointment to fulfil the duties which a son owes to his parents; no two relations within the fourth degree can sit together at the same board; persons of all descriptions are invited to send informations against officers of government to the tribunal of the *Co-tao.* In consequence of these restrictions and the espionage which arises out of them, a magistrate may congratulate himself if he retires from office free from punishment.

Laws.—Sir George Staunton has lately translated the *Ta-tsing-leu-lee* into English, a work which comprehends an outline of the whole system of government, and of civil and criminal jurisprudence. *Ta-tsin* is the name of the present dynasty which succeeded to the throne in the year 1664; *leu* relates to the ancient statutes of the empire; and *lee* is expressive of the later enactments. This work is published in a popular style, is widely circulated among the people, and every one who has any pretensions to literature is familiar with its contents. The whole code consists of six principal divisions, corresponding to the six departments of the government. The first division, which relates to the *Lee-poo*, or the department whose office it is to examine candidates for employment, and to nominate to appointments, defines the duties, and regulates the offices of the several magistrates, the rule of hereditary succession, and the penalties attached to malversation. In the second section of this division, the duties of the provincial mandarins are pointed out and explained. The second division of the code contains the laws of the Hoo-poo or board of finance. These are various, and relate, 1. To the enrolment of the people, personal services, levying of taxes, punishment of persons deserting their families, care of the aged and infirm; 2. The law of holding and disposing of land and other property; 3. Regulations respecting marriage and divorce, of which barrenness, lasciviousness, neglect of her husband's parents, talkativeness, thievish propensities, envious and jealous temper, and incurable disease, are recognised by the law as justifiable causes,—yet notwithstanding her conviction of one or more of these offences, if she can plead that she has mourned three years for her husband's parents, that he has become rich since the time of their marriage, or that she has no parents living to receive her, the law does not allow a wife to be divorced from her husband; 4. Relates to public property, coinage, and the revenue of public stores; 5. Duties and customs, smuggling, &c.; 6. Private property, the law of usury, of trusts, &c.; 7. The rules of sales, markets, weights, measures, &c. The third division of the code has a reference to the duties of the Lee-poo, or board of ritual observances, the care of the altars, sacred terraces, and tombs, unlicensed forms of worship, magicians, leaders of sects, and teachers of false doctrines; and a second section of the same division lays down the law respecting court etiquette, public festivals, funerals, dress, furniture, and habitations. The fourth division of the code is taken up with the statement of the military law, and consists of five sections; the first of which relates to the duties of the imperial guards, the protection of the emperor's person and his palace, the examination of passports, &c.; the second is entitled the government of the army, the mutiny act, and articles of war of China; the third relates to the defence of the frontier; the fourth, to the horses and cattle belonging to the army; and the fifth, to the conveyance of dispatches.

The fifth division of the code contains the law by which the procedure of the Hong-poo or criminal tribunal is directed, and consists of eleven sections. The first awards the punishment for every species of robbery and theft. The second relates to *homicide* in all its degrees of guilt. A husband may kill his wife and her paramour, if caught in the act of adultery; a thief or a robber previous to his apprehension may be put to death. But every case of accidental homicide subjects to strangulation, and premeditated murder to decapitation. Barbers, and practitioners of physic, if they kill by cutting, puncture, or poison, through accident or error of judgment, may redeem their offence with a fine; but if through noncompliance with the established rules of practice, or from intention to kill or injure their patients, they must suffer the highest punishment of the law. The third section of this division relates to quarrelling and fighting. It awards the penalty of death to every slave that shall strike his master; allows parents to chastise a disobedient child even to death; and it also permits parents to sell their children to slavery, except to strolling players and professors of the magic art.

The fifth section respects indictments and informations of all kinds. The sixth provides against every possible case of bribery and corruption. The seventh relates to frauds and forgeries, falsification of the imperial seal or almanack, counterfeiting the current coin, &c. The eighth relates to all cases of incest and adultery. The ninth takes cognizance of gaming and stage performances. The tenth and eleventh sections contain regulations respecting arrests and escapes, imprisonments, judgments, and executions.

The sixth and last division of the code regards the duties of the sixth department of the administration, denominated Kong-poo, or board of public works. It is divided into two sections, the first of which contains regulations for the repair of the public buildings; the second for that of the public roads, bridges, and embankments of the rivers. In these different divisions, crimes, with their punishments, are minutely detailed; the whole of which exhibit such a medling interference with the concerns of private life, as to render them totally unfit for practical application, except to such mere machines as the Chinese are, for whom they seem to be admirably fitted to answer every purpose.

At the head of the code are placed ten treasonable offences. 1. *Rebellion*, defined an attempt to violate the divine order of things on earth. 2. Disloyalty, an attempt to destroy the imperial palaces, temples, and tombs. 3. Desertion to a foreign power. 4. Parricide, or murder of parents, uncle, aunt, grandfather, or grandmother. 5. Massacre, or the murder of three or more persons in one family. 6. Sacrilege, or stealing from the temples any sacred article. 7. Impiety, or negligence and disrespect of parents. 8. Discord in families. 9. Insurrection against magistrates. 10. Incest. These crimes are regarded as too heinous to admit of pardon, or even of mitigation of punishment.

The most prominent punishment among the Chinese is flagellation with the bamboo. The size of this scourge is limited, and the number of blows to be inflicted is prescribed by solemn enactments. The larger bamboo is restricted to 5 feet 8 inches in length, $2\frac{3}{4}$ inches in breadth; the smaller is appointed to be of the same length, but a little narrower and thinner.

The Kia is a wooden collar for the neck, three feet long, two feet nine inches broad, and about thirty-three pounds in weight, which, however, as its weight is increased according to the guilt of the criminal, it is sometimes 200 pounds. A delinquent is sometimes obliged to wear this ignominious collar in highways, streets, and squares, for months together, with a label attached to it expressive of the crime and the punishment which has been awarded.

The iron chain by which all criminals are confined is seven feet long, and weighs upwards of 60 pounds; besides which they are bound with wooden handcuffs and iron fetters.

Evidence and confession are extorted by torture. But from this the eight privileged orders are exempted, and also all those who are above 70 or under 15 years of age, and those who labour under any permanent infirmity.

The degrees of punishment are, 1. A moderate correction inflicted with the lesser bamboo. This punishment extends from 10 to 50 blows; but 10 blows of nominal punishment is in practice reduced to four, and 50 to 20. The second class of punishments extends from 60 to 100 blows, of which from 20 to 40 are inflicted. The third is temporary banishment to any distance not exceeding 500 *lee*, or 150 miles. The fourth, is perpetual banishment to the distance of 2000 and even 3000 *lee*, with 100 blows of the bamboo. The fifth, and highest punishment is strangulation, or decollation. Instead of the bamboo, fine and degradation are inflicted on offending mandarins; and indeed almost every species of crime is redeemable with money.

Prisons.—Convicted criminals are kept in prison till a certain day in autumn, when the sentence which the laws have awarded to each is executed throughout the empire. The prisons are said to be large and airy, with extensive court-yards attached to each of them. Men and women, felons and debtors, are kept in separate apartments. The prisoners have a small allowance of rice from government, and are permitted to work at their respective professions, and to apply their earnings to their own use; they have also the privilege of being visited by their friends and relatives, and of receiving from them what they may find it convenient to impart for their comfort.

Revenues.—Taxes in China are in general levied in kind, but their annual amount has not hitherto been ascertained by Europeans. The impost of the tenth part of all the produce of land is by far the richest source of the revenue. The lands are all carefully registered, their value calculated, and the expense of cultivation deducted. The tax on salt is next in value to that arising from the land. Grain, silks, cottons, and manufactures of various descriptions also pay a duty to government in kind; and in seasons of peculiar emergency a forced loan, which is never repaid, and a capitation tax, are exacted. But in ordinary cases, according to Barrow, the total amount of taxes, and assessments which each individual pays to the state, taken on an average, does not exceed four shillings annually. A shilling in China, however, is worth about three in Great Britain.

The revenue arising from all these sources is deposited in public magazines, from which the civil and military establishments, and all the incidental expenses of the provinces are defrayed, and then the surplus is sent to Pekin to meet the expenses of the court.

Army.—Lord Macartney was told, that the military establishment for the defence of the empire consisted of a million of infantry, and 800,000 cavalry, and that the annual expense of such a mass of armed men amounted to a sum little short of fifty millions of pounds Sterling. This, however, is thought to be an exaggerated account, and the whole amount of armed men in the empire has been supposed to be about eight or nine hundred thousand men, infantry and cavalry included. The Tartar cavalry are stationed on the northern frontier, and in the distant provinces, and the Tartar infantry are distributed as guards for the different cities of the empire. But the Chinese heroes are sent into the smaller towns, villages, and hamlets, where they act as jailors, constables, thief-takers, collectors of taxes, and guards of the military posts along the public roads, canals, and rivers. At each of these posts, which are little square castles, with a watch-tower and a flag on the summit, seven or eight men are stationed. These castles occur at the distance of every four or five miles; and their little garrisons prevent robberies, and convey dispatches. An express sent in this way goes at the rate of 100 miles a-day.

"The military dress varies in almost every province. Sometimes they wear blue-jackets edged with red, or brown with yellow; some have long pantaloons, some breeches with stockings of cotton cloth; others petticoats and boots.—The bowmen have long loose gowns of blue cotton, stuffed with a kind of felt or wadding, studded all over with brass knobs, and bound round the middle with a girdle. On the head they wear a helmet of leather or gilt pasteboard, with flaps on each side which cover the cheeks and fall over the shoulders; the upper part is like an inverted funnel terminating in a long pipe, to the top of which is tied a tuft of hair of a scarlet colour."

They are armed with bows and arrows, swords and sabres, and match-locks in place of muskets. There is a corps of the army called the *tygers of war*, armed with long swords, and shields of basket-work, on which are painted monstrous faces of an imaginary animal, intended to frighten the enemy, or, like another gorgon, to petrify the beholders. Every soldier is also furnished with a fan and an umbrella, and is oftener employed in the exercise of his fan than his match-lock. These fans, together with their quilted petticoats and satin boots, give them a clumsiness and an effeminacy that ill accords with the military character. When drawn out they are extended in a single line in front; every fifth man has a small triangular flag, and every tenth man a large one of the same form, the staffs of which are fixed to the jacket behind the shoulders. Some of the flags are green, edged with red, others are blue edged with yellow.

Although gunpowder, or a compound possessing similar properties, was probably known to the Chinese for ages prior to its discovery in Europe, it does not appear from their annals that they made use of fire-arms in war at any very early period; and it is not unlikely that they derived their first knowledge of fire-arms from the Jesuits, along with other important pieces of information. Mr Bell observed some hundreds of old cannon piled up in one of their towns, formed of hammered iron, fastened together with iron hoops; and those which travellers have recently observed scattered about the gates of some of the cities are rude, ill-shapen, and disproportioned pieces of cast-iron, perhaps the very same which were cast by the instructions of fathers Verbiest and Schaal. In the time of action the match-locks are fixed on forks stuck in the ground.

The Tartars, from the opposite habits of their youth, are more disposed, and better fitted for a military life than the Chinese; and consequently the troops, especially the cavalry, are composed of a greater proportion of the former than of the latter. The Tartars have also higher pay than the Chinese. A Tartar trooper is paid seven ounces of silver, and 20 rations of rice every lunar month, while a Chinese has only three ounces and 15 rations in the same time. The infantry of both nations are paid at an inferior rate, but in the same proportion. Arms, clothes, and accoutrements, are furnished by the emperor to all the soldiers; and, besides their ordinary pay and allowances, they also obtain donations on particular occasions. On the death of their parents they receive *a gift of consolation*, as do their families when the soldiers themselves die.

General police.—The practice of keeping a register of all the lands of the empire under culture, with specifications of their fertility and other qualities, and of taking a census of the population at particular periods, enables the boards of administration to adapt their measures to the existing state of the country; and the annual calendar, which contains a statement of all the festivals and holidays, with the ceremonies and services of religion, and the Pekin gazette, which is printed daily, detailing every object of government, and every public, and many private occurrences, contribute powerfully to preserve uniformity of observances, and order and tranquillity throughout the empire, as well as to impart gratifying information to all who are at a distance from the imperial palace whence these publications are issued, and thence find their way to the remotest of the provinces, and into the obscurest of their habitations. Great care is also taken to keep the roads, bridges, canals, and embankments of the rivers in a state of repair at the public expence, and the frequent occurrence of military posts insures safety to the traveller. The principal mode of travelling in China is by water, in barges, which waft passengers with their baggage along the canals and rivers. A great number of porters are also employed to convey goods from town to town, as well as travellers, in sedan chairs, palanquins, carts, and barrows with one wheel, and a sail. Little use is made of horses in travelling, or in the carriage of commodities, except in the north, on the frontiers of Tartary. The inns of the country are wretched hovels, unfit to afford accommodation or rest to the weary traveller, except those which have been fitted up at the public expence, for the convenience of the emperor's officers. The laws of China make no provision for the poor, and yet mendicity is scarcely known. The children, if living, and if not, the next of kin, must take care of their aged parents, or relations, and the parents dispose of their children in what manner they may think best for the interest of the family. In cases of real distress the government acts the part of the parent, and supplies grain, and other necessaries, out of the imperial magazines, but there is not a pauper of any description supported by funds that have been levied on the public.

The police of Pekin, and of course of the other cities, is so well regulated that the safety and tranquillity of the inhabitants is seldom disturbed. There are guard-houses in some of the streets, and sentry-boxes at short distances, in each of which a soldier is placed. Every tenth householder is also obliged in his turn to keep the peace, and to be responsible for the conduct of his nine neighbours. The soldiers on guard patrole the streets, and beat the hour upon a short tube of bamboo. The streets, however, are covered with dust, and thefts and robberies and riots are said not to be unfrequent.

Language.—The Chinese are still more distinguished from the rest of mankind by the peculiar character both of their oral and their written language, than they are by any of their other singularities; and by their language alone, which exclusively belongs to themselves, the antiquity of their origin is incontestibly proved. Their oral language, expressed by European letters, does not exceed 380 distinctions of sound, which they, however, by means of inflexion and accent, contrive to increase to about 1300. Every word in the language is a stiff unbending monosyllable, beginning with a consonant, and terminating with a vowel, a liquid, or the double consonant, *ng*, and is by turns a noun, substantive, an adjective, a verb, and a participle, but subject neither to gender, number, nor case, mood, tense, nor person, these and the other accidents of speech being designated by prefixes and affixes. Thus *jin*, man, becomes in the genitive *jin-tie*, of man; in the dative, *eu-jin*, to man; and in the ablative, *tung-jin*, with, by man; the accusative, or objective case, is pointed out by its position immediately after the verb. The plural number is expressed by a repetition of the singular, or by certain particles placed before the noun. Thus *jin-jin*, men; *to-jin*, many men; *to-to-jin*, all men. The genders are expressed by the syllable *nan* for the masculine, and *nen* for the feminine. Thus, *nan-jin*, man; *neu-jin*, woman; but this reference to sex is not resorted to unless on the occurrence of some ambiguity in conversation or conference. Nouns become adjectives by the addition of the affix, *tie*, and admit of comparison in various ways, but commonly by prefixing the syllable *keng* for the comparative, and by repeating the word for the superlative. Thus *hau*, goodness; *hau-tie*, good; *keng-hau-tie*, better; *hau-hau*, very good.

The personal pronouns are, *go*, *ne*, *ta*, I, thou, he, which are rendered plural by the affix, *mun*; thus, *go-mun*, *ne-mun*, *ta-mun*, we, ye, they; and by adding the sign of the genitive, they become possessives. The demonstratives are *che-ko*, this; and *na-ko*, that.

The tenses of verbs, which are only three in number, the present, the past, and the future, are expressed by particles. Thus, *gai*, love, is varied *go-gai*, I love; *go-gai-leau*, I have loved; *go-yau-gai*, or *go-tchang-lai gai*, I shall love hereafter, or I am determined to love. The negatives in most common use are, *mo*, not; and *poo*, bad, or deficient.

The expression and elegance of this simple speech depend chiefly on the position of the particles, and that of its other auxiliaries. But in consequence of the paucity of its syllabic sounds, the same word frequently occurs in a great variety of different acceptations, which renders it a very imperfect vehicle of communication. And this tendency to ambiguity in the use of the colloquial language is increased by means of the variety of dialects which prevail in the different provinces. When these difficulties of being understood occur, the Chinese have recourse to their written language, the characters, with the respective signification of which, are the same throughout the empire, as well as in most of the surrounding states.

The principles and structure of this written language of China are altogether peculiar. It is not alphabetical, like the languages of the rest of mankind, but every separate character is the symbol of a distinct idea. And though the syllabic sounds of the colloquial speech are extremely few in number, the characters of the written language amount to the immense aggregate of 40,000. This singular contrivance for the inter-communication of ideas, which was at no distant date utterly inaccessible to foreigners, has lately been rendered of comparatively easy attainment, by the laudable researches of our countrymen, Barrow, Marsham, Morrison, and others, who have applied their talents and their industry to trace its history, and to unravel its principles.

The Chinese, like the Peruvians, are said to have originally registered events by means of knotted cords; and though the symbols by which they communicate with each other, as well as by which they keep their records, bear no obvious resemblance to their prototypes, yet the inscriptions on ancient vases and seals afford evidence that their writing was at first a rude species of painting, and also enable us to trace the step by which the pictures of objects have at last been converted into their arbitrary signs.

Mr Morrison carries back the invention of writing to the reign of Hoan-tee, in the year of the world 2900, and gives the honour of it to a man named Paou-she. The idea is said to have been suggested to his mind by observing the figures delineated on the back of the tortoise, and that nine-tenths of the letters were rude drawings of the objects they were intended to represent. In after times the print of birds feet in the sand, the waving lines described by worms and serpents, the form of the leaves, branches, and roots of trees, suggested a variety of additions to the stock of symbols, and alterations and abbreviations of those which were already in use. These symbols, which stood for the sensible objects of nature, such as the heavenly bodies, quadrupeds, birds, fishes, and reptiles, and those which represented objects of art familiar to all from their general usefulness, such as a house, a boat, a bow, were imitations of their respective prototypes. As the qualities of objects could only be expressed by arbitrary signs, they of course behoved to be settled by convention; but even they originally were founded on known analogies, by which the figure exhibited to the eye served as an index to the sense it was intended to convey to the mind.

It is obvious that, as the aggregate of significant characters now in use amounts to 40,000, all pronounced as monosyllables, beginning with a consonant, and ending with a vowel, or a liquid, the same syllabic sound must be continually recurring; and that this circumstance, unless counteracted by some adequate contrivance, must be a fertile source of perplexity, doubt, and mistake. To prevent as much as possible the confusion which this could not fail to occasion, the Chinese have had recourse to various methods of analyzing their language into its elementary principles, and of arranging its characters into distinct classes. The system which prevails at present is a two-fold division of the characters, the one grounded on the principle of their formation, the other on that of the sense they express. They arrange the ele-

China.

mentary characters, which amount in all to 214, into 17 divisions, according to the number of the strokes of the pencil employed in their formation; the first division consisting of characters of one stroke, the second of those of two strokes, and so on through all the seventeen. These 214 elementary characters are denominated by the Chinese themselves *Tse-moo*, mother characters—*Tse-poo*, directing characters.—and *Shoo-moo*, the eyes of the book. But by Europeans they are designated the elements, the keys, and the roots of the language. Chinese dictionaries are divided into 17 sections, to correspond with the 17 classes of radicals, under which are arranged respectively all the characters having one of the same class of radicals in its composition. In the formation of characters, the key or radical letter has been made to assume every possible variety of position, sometimes above or below, on the right or the left, or the middle of the symbol with which it is associated, and which it characterizes. On this account it is incumbent on students to be well acquainted with the keys of the language, by which all the treasures of the Chinese philology and literature are unlocked. Thus, under the key letter, which signifies *heart*, are arranged all those characters expressive of the sentiments, passions, and affections of the mind. Under the key *water*, all the compounds which relate to seas, rivers, lakes, swamps, depths, transparency, &c. The key *plant*, comprehends the whole vegetable creation. The key *word*, has under it conversation and literary pursuit of every description.

After the division of the characters of this language, suggested by the forms and powers of its elementary principles, which (like our arrangement of words in their alphabetical order, or our classification of natural objects according to some generic characteristic) grouped them under arbitrary heads, some rational arrangement of them, according to the nature of the objects they were employed to represent, was still to be desired. And towards a classification of this kind the Chinese have made several attempts.

The first system of this kind of arrangement which obtained a currency among them, was that denominated *Leu-shoo*, which exhibited the characters of the language in nine divisions. The *first* class comprehended all the simple letters in the language; the *second* all those that related to celestial objects; the *third* all those expressive of terrestrial objects; the *fourth* man and animal functions; the *fifth* the inferior animals; the *sixth* the vegetable world; the *eighth* miscellaneous objects; and the *ninth* all those whose nature was not understood. But the *Leu-shoo* has long ago been supplanted by the *Lo-tchoo*, a classification of the language in six divisions.

1*st* Class comprehends the primary principles of the language, and the symbols of the great objects of nature, and are imitations of what they represent.

2*d*, Those characters expressive of qualities and metaphorical analogies. Thus *little* and *strength* denote weakness. A figure in the form of a square cut in two by a perpendicular line, stands for division, moral rectitude, and good dispositions.

3*d*, Contains the characters, combined, of two or more that are simple in their signification, from the union of which new ideas result. Thus *man* and *word*, signifies *sincere*; *sun* and *moon*, *splendour*; *mouth* and *dog*, to *bark*; *bamboo* and a *clapping* noise, to *govern*.

4*th*, Those characters, the sound of which is supposed to be an echo to the sense, and embrace objects both animate and inanimate. The component parts of the characters of this class, are a key expressive of the genus, and of another character imitative of the sound of the object or the animal intended to be expressed. Thus *water* and *rapid*, denote a river. *Bird* and *go*, make goose.

5*th*, Those which have an inverted and figurative signification. Thus *sun* and *moon*, which in their physical sense signify splendour, are expressive metaphorically of whatever is famous or illustrious—*speech* and *mountain* united, come to signify boasting—*heart* and *dead*, forgetfulness—a girl represents levity and fickleness—the wife of a magistrate an accomplished lady.

6*th*, Those whose signification is either wholly arbitrary, or which is founded on such far-fetched analogies as, in the generality of cases, they cannot be traced. Thus a *bamboo* and *heaven*, form a compound which signify to laugh—*water* and *to go*, denote law—and vain promises are indicated by a word and a man walking.

This approximation towards a philosophical arrangement of the language, though evidently extremely imperfect, is yet of vast advantage to the natives, and still more to foreigners, in facilitating the attainment and regulating the use of this clumsy apparatus of inter-communication. It is obvious also, that many of the radical letters are by far too complicated in their form (being compounded of many lines) to be of much use in the formation of other letters still more complicated. And consequently it happens, that of the 214 generic or key-letters, not more than about 150 are much employed in the composition of those which are of a specific nature; and even of the 40,000 of which the language consists, not fewer than 25,000 of them are formed by the aid of only 60 of the radicals. The Chinese written language is understood by many of the natives of Japan, Tong-king, Cochin-China, &c. (in the same way that a piece of music or an operation in algebra, would be by the different nations of Europe), though they cannot converse together in their respective spoken languages; and, consequently, all their intercourse, even when in each others company, must be carried on in writing. As the expletive particles, liberally employed in familiar conversation, are not expressed in writing, a Chinese book can scarcely be read so as to be understood by a company of mere auditors. The written character is addressed exclusively to the eye, and must be seen before it can be understood. Foreigners, not aware of this exclusion of the particles of speech from written composition, are often, after they have become adepts in decyphering the character, betrayed into ridiculous mistakes in attempting to converse in the language, and even the natives, in their conversations with each other, are obliged to accompany their pronunciation of words with a description of them in the air with their finger, or their fan.

Education.—As, under the imperial family, there is no hereditary rank in China, and as all honours and offices are the reward of eminence in learning, every parent who has the means is careful to put his offspring in the way of preferment, by giving them as liberal an education as he can afford. Hence schools are abundantly disseminated throughout the empire, and a full half of the inhabitants are supposed to be able both to read and write. Nothing, however, seems more absurd than their mode of instruction. The pupil is first employed in learning the proper name of the characters, without regard to their analyses or signification; then he must learn to write them, and to name the lines and points of which they are composed; and lastly, he learns to analyse the characters into their elementary principles, and to understand their signification in composition. By this time the pupil has arrived at manhood. The class-books of the schools are, first, the book called *The Proper Names of a Hundred Families*, which contains the most common distinctive appellations of the Chinese, all of which are significant words; 2d, *A Collection of Letters*, which treats of common things, and the necessary articles of life; 3d, A book of short phrases; 4th, A collection of verses; 5th, The moral precepts of Confucius, which must be committed to memory. When these are mastered, the pupil is introduced to the *King*, or classical books: and after having made some proficiency in the study of them, he undergoes his first *examination*.

This examination is conducted by a mandarin, who has the government of a city of the third order, and after it the pupil receives the title of *Hien-ming*. The second examination is before the governor of a city of the first order, to whom, if he gives satisfaction, he is afterwards called a *Foo-ming*. After this he undergoes a variety of other examinations, writes themes on prescribed subjects, competes with his fellows, and is distinguished by titles and badges indicative of his literary degrees and merits. The highest of these titles is *Tsin-tse*, doctor, after the attainment of which he is eligible into the highest and the most honourable offices of the state.

Literature.—As learning is thus easy of access, and is, in fact, to a certain extent generally diffused, and still more as it is the only introduction to the walks of ambition, and also as the press is free to all, without restriction or control, or previous licence, we might reasonably expect that the literary compositions of the Chinese, accumulated, in the course of generations, would, by this time, be astonishingly great. But although we have been told by travellers and philologists that this is indeed the case, we have not hitherto been enabled to enter very deeply into the study of Chinese literature, or to ascertain very accurately the subjects which it embraces, or the manner in which they are treated. If it be true that, with the exception of a few fragments, all the works of the learned were destroyed by an edict of the emperor Chi-hoang-tie, about 200 years before the Christian era, (as the Chinese themselves assert, but which is called in question by foreigners,) it is not easy to see what authority is due to the annals of the empire which shoot so far back into antiquity.

Most of the five *King*, or classical books, all of which are held in high estimation by the Chinese, have been translated into French by Father Mailla and other Jesuits, but in a manner too paraphrastic to convey an accurate idea of the original. The *King* are, 1*st*, The Shoo-king, a collection of records and annals, commencing more than 2000 years before Christ; 2*d*, Shu-king, sonnets and maxims, written in a style extremely metaphorical and obscure; 3*d*, Ye-king, the lines of Fo-shee, the most ancient relic in China, and perhaps the first attempt at written language, but now perfectly incomprehensible; 4*th*, Chung-choo, spring and autumn, a work composed by Confucius; 5*th*, Le-ke, ceremonies and moral duties, also by Confucius. There are also five inferior *King*, among which are four books of Confucius, called, *Sublime Science, Just Medium, Words, and Discourses*, the works of Ming-tse, books on rites and ceremonies, filial piety, commentaries, and historical records. An abstract of the Chinese laws has been lately translated into English by Sir George Staunton, from which much of the jurisprudence of that extraordinary people may be learned. An encyclopædia of the arts and sciences was published in 200 volumes, under the patronage of the emperor Kien-lung; as also another work, containing the whole institutes of the empire, an abstract of which has been given to the European reader in French, by Cibot. Novels, plays, and poems daily issue from the press, to gratify the craving appetite of an extensive reading public. Libraries, however, are seldom formed to any great extent by private individuals. But there are circulating libraries in the cities, pamphlets and the Pekin gazette in all the *tea houses*, and extensive collections of books on all subjects in the temples of Fo. The national standard works, on history, philosophy, religion, law, and other subjects, are published under the superintendence of the *Han-lin*, or literary college, who have their residence at court, and are distributed to the princes of the blood, viceroys of provinces, and other state officers. The circumstance of a free press in an absolute government is a political problem which it is not easy to solve. But though all may print who choose with the most unrestrained facility, yet the laws against treasonable, seditious, licentious, and irreligious publications are extremely severe, and are most rigidly executed on all who venture to violate them.

The Shee-king, one of the classical books, contains a collection of poems, some of which possess a high degree of poetic merit. The lines are of unequal length, consisting of from three to seven characters. In some every line terminates with the same word, and in others the recurrence of rhymes is at the interval of several lines. But most of their poetry is a kind of elevated and measured prose. They have also a species of poetry addressed exclusively to the eye; and consists of such a selection and arrangement of characters as is fitted to suggest agreeable associations to the mind. Thus, the head is the *sanctuary of reason*; the ears, *the princes of hearing*; the nose, the *mountain of fountains*, and so forth.

A stanza of one of the odes of the Shee-king, which has been elegantly paraphrased by Sir W. Jones, may serve as a specimen of that sort of Chinese poetry addressed to the ear. Literally translated, it is as follows:

1 2 3 4 5
The peach tree, how fair, how graceful its leaves,
6 7 8 9 10
how blooming, how pleasant; such is a bride, when
11 12 13
she enters her bridegroom's house, and attends to
14 15
her whole family.

This simple thought, in the hands of a poet of another language, becomes,

Gay child of spring, the garden's queen,
Yon peach tree, charms the roving sight;
Its fragrant leaves how richly green!
Its blossoms how divinely bright!

So softly smiles the blooming bride,
By love and conscious virtue led
O'er her new mansion to preside,
And placid joys around her spread.

The emperor Kien-lung, of venerable memory, was a poet of the first order, and has published poems on various subjects. His poem on the praise of Mookden, a Tartar city, is written in measured prose, and has been translated into French by Father Amiot; His conquest of Miao-tse, by Mr S. Wiston into English, through the medium of the French.

In their rhetoric, the Chinese affect much solemnity of manner and brevity of expression; but they distinguish compositions of this kind into an endless variety; such as *the eloquence of candour*, which banishes doubt and *suspicion; the eloquence of things*, an exhibition of the power of truth; *eloquence of sentiment*, the effusion, as it were, of the orator's soul; *the eloquence of combination*, the fruit of much study; *the eloquence of wonder*, which subdues reason by astonishing the imagination.

Drama.—If the amusements of the Chinese theatre be taken as the criterion of the civilization, morality, and genius of that people, they must in all these respects rank extremely low in the scale; for they abound in the most scurrilous buffooneries, the grossest indecencies, and the most puerile tricks. The subjects of their pieces are chiefly of an historical or allegorical description, and are taken from the transactions of their ancestors previous to the Tartar conquest, or from some of the most remarkable phenomena of nature. Their historical plays are divided into acts, and comprehend the whole history of a hero, and not unfrequently of a whole dynasty. But there is no shifting of scenes in any part of the performance; when a general is sent on a distant expedition, he mounts a stick, takes a turn or two around the stage, brandishes a whip, and sings a song. The dialogue is partly in singing, partly in recitative, and partly in plain speaking; and the action abounds in battles, murders, and in the other incidents of the drama. The dresses of the actors are conformable to the costume of China at the period to which the piece relates; the parts of females are performed by boys and eunuchs, and many of the scenes which are exhibited are too grossly indelicate and shockingly horrid to be witnessed by foreigners. They have a hundred historical plays published together in the same work, which concentrate all the excellencies of their drama, and which are regarded as the classical stock pieces of their stage. Yet all of them contain obcenities and horrors in abundance, all of which are fully and faithfully exhibited in the performance. In one of these standard dramas, which is frequently represented, a woman murders her husband during his sleep by striking a hatchet into his forehead. He appears on the stage with a large gash just above his eyes, bleeding copiously, bemoans his fate, reels, falls, and dies; the woman is condemned to be flayed alive, the sentence is put in execution, and in the next act she appears on the stage not only naked, but completely excoriated. If such obscene and horrible exhibitions be holding "the mirror up to nature," it is to nature in her most degraded and corrupted forms, and but ill accords with the boasted morality, high polish, refined delicacy, and grave exterior of the Chinese nation. It has been said that dancing, riding, wrestling, and posture-making, have in a great measure supplanted the regular drama of the Chinese since the Tartar conquest. The former seems to be congenial to the genius and hardy activity of the Tartars, and the latter to be better suited to the manners and customs of the effeminate Chinese. Hence the Chinese officers of state have private theatres in their own houses, where the national pieces are performed by itinerant actors; and when the Hong merchants at Canton entertain their European customers, a play is performed at the end of the hall in which the guests are employed in eating bird's nest soup and other viands. Mr M'Leod represents the music on those occasions to be harsh, grating, and stunning in the last degree. "By collecting together," says he, "into a small space, a dozen of bulls, the same number of jack-asses, a gang of tinkers round a copper cauldron, some cleavers and marrow bones, with about thirty cats, then letting the whole commence bellowing, braying, hammering, and caterwauling together, and some idea may be formed of a Chinese orchestra."

Both the British and the Dutch embassies were, while at court, entertained with theatrical exhibitions, of which minute descriptions will be found in the journals of Lord Macartney, Van Braam, and De Guignes. The performances began at eight o'clock in the morning, and continued till noon, and consisted of a variety of pieces in succession both tragical and comical. Those entertainments, at which Lord Macartney was present, concluded with a grand pantomime, the subject of which he conceived to be the marriage of earth and ocean. The earth exhibited her various riches, dragons, and tigers, and eagles, and ostriches, oaks, and pines, and other trees. The ocean also poured forth the wealth of his dominions,—whales, and dolphins, porpoises, and leviathans, ships, rocks, sponges, and corals, all performed to admiration by concealed actors. The whale, immediately opposite to the emperor's box, spouted from his mouth several tons of water into the pit,—an ejectulation which, says his lordship, was received with peals of applause. Tumbling, wire-dancing, and posture-making, with fire-works, (in which latter the Chinese excel), concluded the morning's amusement.

The exhibitions at which the Dutch ambassador and his suite were present in 1795, were chiefly feats of agility and slight-of-hand tricks, followed by a pantomime, in which appeared a great variety of beasts of chace pursued by mandarins. This extraordinary chace put the old emperor in such good humour, that he rewarded the performers very liberally; and it appeared, from the tittering of the ladies, who were concealed behind Venetian blinds, that they too were well entertained. A dramatic representation of an eclipse of the moon, is thus described by De Guignes: "A number of Chinese, at the distance of six feet from each other, now entered, bearing two long dragons of silk or paper, painted blue with white scales, and stuffed with lighted lamps. These two dragons, after saluting the emperor with due respect, moved up and down with great composure, when the moon suddenly made her appearance, upon which they began to run after her; the moon, however, fearlessly placed herself between them; and the two dragons, after surveying her for some time, and concluding, apparently, that she was too large a morsel for them to swallow, judged it prudent to retire, which they did with the same ceremony as they entered. The moon, elated with her triumph, then withdrew with prodigious gravity, a little flushed, however, with the chace which she had sustained."

In short, says Barrow, the greater part of the amusements of the Chinese are at the present day of a nature so very puerile, or so gross and vulgar, that the tricks and the puppet-shows which are occasionally exhibited in the fairs of the country-towns of England, may be regarded as comparatively polished, rational, and interesting. In slight-of-hand tricks, in posture-making, rope-dancing, riding, and athletic exercises, they are much inferior to Europeans, but in the variety of their fire-works they perhaps carry the palm against the world. A hundred companies of comedians, each consisting of upwards of fifty individuals, and composed of speakers, musicians, tumblers, and jugglers, are said to live in passage-boats at Pekin, and are thence transported wherever they are wanted. These persons are also said to be ready at a moment's warning to perform any play out of a list of a hundred, and to go to any place to which, for that purpose, they may be called.

Music.—It would appear from the records of China, that the musicians of the country anciently bore a strong resemblance to the Celtic bards. They are spoken of as the poets, historians, and moralists of the empire; and effects are attributed to their compositions and performances similar to those produced by the strains of Orpheus or the lyre of Amphion: "When I strike upon my musical stone," (said Kuei, the chief musician of the emperor Chun,) "the wild beasts of the forest testify their joy; and the people and their rulers are of one accord." But if the ancient was like the modern music, it must have been incapable of moving any other class of creatures except wild beasts and barbarians. For it is asserted to have neither science nor system, and that in its performance it is either loud and harsh, or dull and drawling. Neither is it practised by private individuals as an amusement, but is left entirely to professional performers, who wander, it is said, among flats and sharps, and pass from tones to semitones, and quarter-tones, without any fixed rule, and in a manner inconsistent with harmonious concert. Their gamut consists of five tones and two semitones, but their music is not written in lines and spaces. They merely note down the characters in succession in a column, as they are played, without distinction of time, key, or expression. Their airs are sung to slow movements of a plaintive or a querulous cast, and are always accompanied by some stringed instrument similar to a guitar.

The Chinese have a great variety of instruments, the greater number of which is fitted to make noise enough, if not music. They have drums of an enormous size; sonorous stones, cut in the shape of a carpenter's square; bells, and gongs, and cymbals, of various forms; instruments peculiar to themselves, made of baked earth; lyres and guitars, with strings of silk; wooden instruments, shaped like hollow vessels, and different kinds of animals; flutes, and pipes of a shrill and piercing sound; and a kind of small organ, formed of unequal reeds, something like the pipe of Pan. The jarring, jingling, and squeaking noise emitted from a full band of such instruments, is said to be extremely offensive to a musical ear. It is a remarkable peculiarity in the use of these instruments, that for the most part females perform on the flutes and pipes, and males on the lyres and guitars.

Painting and sculpture.—It is not to be expected that in a country whose poetry and music are still in a state so rude and imperfect, that the kindred arts of painting and sculpture have attained to any high degree of eminence. The Chinese painters are said to be ignorant of the first principles of perspective, and that, when left to themselves, they can neither invent, nor group, nor give any idea of distance, magnitude, expression, or of the light and shade of objects; but that when a copy is presented to them, they can imitate it with accuracy. The artists of Canton especially, from their being in the habit of copying from better models than can be commanded elsewhere, are superior to any that even the imperial palace can boast. Their sculpture is equally destitute of principle and taste. Every temple, bridge, and burial-ground exhibits figures of men, women, quadrupeds, and other animals, in wood, stone, metal, and baked clay, so grotesque and monstrous as never to have existed, unless in the distorted imagination of the sculptor. The artists of this class can, however, use their tools with dexterity; they can engrave on wood, stone, and metals; and they are expert in polishing and cutting precious stones.

Sciences.—The Chinese are still more profoundly ignorant of the principles of abstract science, than they are of the rules of the fine arts. Their knowledge of mathematics is bounded by a few practical rules. Their numerical notation is marked down by symbols of the language. Their knowledge of geography is very defective, so that they are still ignorant of the true figure of the earth, and possessed no maps of their own country till they were furnished by the Jesuits. Their *swan-pan* by which the common operations of arithmetic are performed, is a very mechanical affair, consisting of ten rows of balls strung on copper wires separated into an upper and an under division. In the superior division are two balls, each of which represents five; in the inferior are five balls, each expressive of unity. They are indebted to the Jesuits for all they know of natural or experimental philosophy; of clock-making, dialling, optics, and electricity, they know nothing, and of hydrostatics and hydraulics very little; manual strength in general supplies the place of mechanical power. Though their knowledge of the principles of chemistry be equally limited as of those of the other sciences, they are acquainted with many useful processes resulting from their application. They are well skilled in the smelting and purification of the metals; understand the methods of heating water, and softening horn by steam; and can extract the greatest brilliancy and variety of colours, from the mineral, vegetable, and animal kingdoms. They purify muddy water by the use of alum; and are well versed in the practice of distillation, and thereby produce an ardent spirit from rice and other grain.

Liberal professions.—Physicians and surgeons are the only classes of men who can properly be said to belong to the liberal professions in China. As the Emperor is the only high-priest, and as no preference is given to any of the religious sects existing in the country, there are no ministers of religion paid by the state; and as there is no pleading in the civil and criminal courts, there are no lawyers distinct from the civil officers of government; the acquisition of learning, therefore, that is, a knowledge of their own language and of their own literature, is the only way by which an ambitious man can rise to eminence. The practice of medicine is chiefly in the hands of the priests, and is attended with very little either of profit or of honour, to which indeed the ignorant quackery of the practitioners is by no means entitled; for they know nothing of anatomy, pathology, or the circulation of the blood, the whole of their attention being confined to the study of the *pulse*. They think every disease arises from disorders in the *animal heat* and *radical moisture*, and passes in its progress from the heart to the liver, lungs, stomach, and entrails; and pretend to be able to ascertain the successive steps of this progress from the pulsations of the wrist, ancles, head, and other parts of the body. As it is contrary to the Chinese ideas of delicacy for the sexes to associate, and still more for a man to touch a lady's hand, the faculty have contrived an ingenious method of feeling a lady's pulse, without violating any of the rules of good-breeding and propriety, and which enables them to prescribe to the fair as successfully as to the other sex, whom they treat in their illness with great familiarity. When a doctor is sent for to visit a sick lady, he is not admitted into his patient's apartment, but a cord is fastened round her wrist, and is brought through the wainscot to the room where the doctor is in waiting, who takes the cord into his hand, looks grave, and then "her disease, and what will mend it, at once he tells."

Their medicines consist of various preparations from the vegetable, mineral, and animal kingdoms. Gin-seng is the most universal of all their medicines, and they prepare it seventy-seven different ways; rhubarb, China-root, and tea, are also in general use; saltpetre, sulphur, and native cinnabar, are taken from the mineral kingdom; and insects, flesh, fat, bones, milk, &c. from the animal kingdom. Most of their medical treatises are mere herbals, describing the names and qualities of plants. Surgery is as little understood as medicine or physic. Phlebotomy, is performed not by opening a vein, but by scarifying, cupping, burning the skin with pointed irons, or puncturing it with silver needles. Cutting of corns, and cleaning the teeth and ears, are abandoned to the barbers. The surgeons can reduce a dislocation or set a fracture, but amputation is never attempted. It is indeed dangerous for professional men, as the laws exist, to venture on operations of any kind, even although their skill rendered it in other respects expedient; for should a patient die in the hands of his medical or chirurgical attendants, their own life is in danger, and not unfrequently goes on very slight evidence, if any thing like improper treatment on their part towards him be ascertained.

The Chinese have hitherto escaped the plague, more, it is supposed, by constant ventilation, burning of sandal-wood dust, by the use of musk and other strong smelling drugs, than by attention to cleanliness. They are subject to the itch, and to a species of contagious leprosy which is found incurable; and therefore, to check its progress, the law has made it a legitimate cause of divorce. The small-pox sometimes commits terrible devastation among their dense population.

Religion.—There is perhaps no country on the face of the earth which exhibits at once a greater want of genuine religion, or a greater grossness of superstition, than that of China. A stranger is astonished when he beholds the numerous temples which tower above the walls of the cities, and crown the eminences throughout the country, all open, and crowded with idols of the most grotesque and monstrous forms; when he beholds the imposing spectacle of swarms of priests dressed in uniform, moving in solemn procession, chaunting in recitative along with bells, and gongs, and drums, and other noisy instruments; and when he beholds that the multitude of millions which compose the population seem *to care for none of these things*, but each individual of them (the priests alone excepted) plying assiduously his own proper business, regardless of all the sacrifices and services of the temples. Nor would his surprise be likely to subside merely by continuing to gaze, however attentively or discriminately, on what was passing under his observation; for there being no sabbatical institution, or regular recurring season of religious rest and social worship, he would see no end to the separation between even the profession of religion and the ordinary pursuits of the great mass of the people. We are not, therefore, to be surprised, that some late travellers have concluded, from the transient view they were permitted to take of the country, that the people of China are almost entirely destitute of religion; that the fraternities of priests, who still reside in the temples, and live on the public bounty, is composed of the lowest of the people, and held in universal contempt.—*Ellis.*

But the doctrines of the ancient religious creed of China, contained in the five classical or sacred books,—whence also the maxims of government and the rules of morality are derived,—are equally pure and sublime. One Deity, represented by no visible form or emblem, but to whom the highest and the holiest attributes are ascribed, is alone recognised. He is known by the names of Whang-tien, illustrious heaven; Chang-tee-tae, the sovereign ruler; Tien-tee, heaven and earth; Che-chung, the first and the last; Ken-puen, root and branch. In some of the prayers of the emperors, recorded in the Pekin gazette, this supreme power is addressed with the profoundest homage, and invoked as the source of every blessing enjoyed by the sons of men, as the ruler and judge of the universe, who rewards the righteous and punishes the wicked. Confucius, the greatest of the Chinese philosophers, who flourished five hundred years before the Christian era, first arranged these and the other doctrines of the ancient writings into a system, into which he incorporated some of his own opinions. He taught that the whole universe was composed of one material substance, which was animated by one spirit (Tien, heaven,) of which every living thing was an emanation that never died, but merely changed the mode of its being; that the body of a man on his decease returned to the dust, but his spirit *to God who gave it,* and was again associated with his ancestors. Thence he inculcated the most profound veneration to the spirits of the departed, whom he directed to be honoured with sacred rites in the *hall of ancestors,*—temples raised to progenitors by the filial piety of their surviving offspring; children to honour and obey their parents, with the deepest reverence and the most implicit submission; and subjects of every station to honour and obey their emperor as they did their parents. In his time the temples were free from idols; but multitudes of *white and black* spirits, the subjects of *the illustrious ruler,* were believed to preside over all the departments of nature, and to influence all the concerns of men.

Nearly coeval with Confucius, a man named Lao-kiun, who had travelled into Tartary, and there become acquainted with the religion of the Lamas, founded the sect denominated Tao-tse, or, sons of the immortals. He taught that the Tao is the intelligent but incomprehensible Author of all that exists in heaven or in earth; that supreme happiness consists in a union with the Tao, a consummation to be attained only by a complete command of the passions; the utter rejection of riches and worldly distinctions, and the entire abstraction of the mind from all sublunary cares. Multitudes embraced these tenets, and, in order to reduce them to practice, were obliged to withdraw from social intercourse and the pursuits of life. The doctrines of these visionaries resemble those of Epicurus; they deal in demons, consult oracles, and pretend to magic and witchcraft. But their most distinguishing tenet is their view of the doctrine of immortality. They maintain, that a liquor may be compounded from ingredients taken from the three kingdoms of nature, capable of renovating the decayed constitution, and of bestowing not only immortality upon the soul, but also unfading youth upon the body. And, notwithstanding the glaring proofs of its want of efficacy, emperors, mandarins, and all indeed who could afford the purchase of it, have, for ages, vied with each other in swallowing (and along with it all the other absurdities of the sect) the *beverage of life,* that they might live for ever. The chief ingredient in the liquor of life is said to be opium, mixed up with a variety of other stimulating drugs, which exhilarate and exhaust the patient, *till at last he puts on immortality.* The priests of this sect are extremely numerous; they live in celibacy and seclusion, and spend their time in magic-tricks and ridiculous mummery.

But the followers of *Fo,* or of Buh, comprehend the greatest mass of the Chinese population. The religion of *Fo,* which is the same with that of Buh, and the Lama, is diffused over a greater extent of territory than perhaps any other. It extends from the Caspian sea to the frozen ocean, and from the banks of the Volga to the islands of Japan. The Gallangs of Calmuc Tartary, the Gelums of the Kirmaylayan mountains, the Gylongs of Tibet, the Rhaahans of Ava, and the Bonzas of China,—the priests or monks of these respective countries, differ little in their tenets, habits, or modes of life. This, which may be regarded as the established religion, as it is professed by the emperor, all his Tartar, and most of his Chinese subjects, was brought from India into China in the first century of the Christian era. The tenets of this faith agree generally with that which Pythagoras is supposed to have imported into Greece from the banks of the Indus. They hold, that all things sprung from nothing, and shall return to nothing; that human happiness consists in an approximation to nothing, the entire extinction of feeling and desire, the suspension of every faculty and function of mental and animal existence, and thereby making the soul free for the occupation of Fo. When the votary dies his body is burnt, and the ashes put into eight urns; and if he were a person of consideration, a temple of nine roofs and eight apartments is erected, and an urn placed in each. But the external doctrine, which has the greater number of adherents, teaches the transmigration of souls, and enforces the practice of virtue from the fear of future punishment, in being made to animate some low or vile animal, when the human form is laid aside. It inculcates the five following precepts: To kill no animated being; to take nothing that belongs to another; to be guilty of no impurity; to utter no falsehood; and to drink no wine. It enjoins prayers to be addressed to Fo; and temples, monasteries, with whatever else they may need, to be provided for his priests.

The number of temples dedicated to the god is altogether incalculable, and exhibits much variety, in respect of their sacredness, magnificence, and splendour. They are open night and day for the reception of those who come with offerings and homage to Fo. The sacred recess, which contains the representation of the god, is furnished with a table on which flowers and perfumes are placed, and with a fire fed continually with odoriferous wood. These temples also contain vast numbers of images of *birds and beasts, and creeping things,* to symbolize the

China. transmigrations of the Deity. Like other idolators the Chinese have an immense multitude of gods of the hills, and the vallies, of the sea, and the dry land, with the gigantic, grotesque, and monstrous emblems of which every temple is crowded. M. Van Braam saw an image of *Poosa*, the all-helping, and plant-preserving goddess, 90 feet high, with four heads and 44 arms; Fo himself is seen seated on the water-lily; Shing-moo, the mother of the gods, or rather of the goddesses, is represented with a glory encircling her statue, with a child on her knee, and with a flower of the water-lily, the emblem of fecundity, in her hand. The figure of the god of thunder is furnished with a pair of expanded wings, with an eagle's beak instead of a chin, and is surrounded with kettle-drums and other instruments of noise. The dragon, held in such high veneration in China, is represented with a buckler of tortoise-shells, sustaining the globe, and watching for its preservation. With the images of the gods, the statues of emperors, mandarins, and other pious persons, are associated. Blocks of stone are in many places set up under the shade of trees, and small chapels are erected in conspicuous places, sacred to divinities of the mountains, rivers, cities, and private houses.

The people, when they turn their attention to the subject of religion at all, are not careful to distinguish between the sects, but content themselves with the occasional observance of either superstition. The emperor regards the grand lama of Tibet as his spiritual superior; but as the high-priest of his own people, he conforms to the ancient observances instituted by Confucius. The *Tans*, or altars of the Tien, were once situated in different parts of the empire, and were visited by the emperor at particular seasons of the year, for the celebration of the great religious solemnities. Now, however, the *Tans* are contained within the imperial city of Pekin. On the Tun-tan, the altar or hill of heaven, he offers oxen, hogs, goats, and sheep, at the winter solstice. On the Tee-tan, the altar of earth, he offers similar sacrifices at the summer solstice. On the Ge-tan, the altar of the sun, he sacrifices at the vernal equinox; and on the Yue-tan, the altar of the moon, he sacrifices at the autumnal equinox. On these occasions the tribunals, and every public office are shut, and business of every kind suspended. The mandarins sacrifice in the temple dedicated to Confucius. A hog is the principal oblation, and the hair and offals of the animal are buried in a grave within the temple, at the foot of the pedestal on which the name of the philosopher is inscribed, and before which the ceremonies are performed. Every magistrate, on his entering on office, after his homage to the emperor, repairs, with his brethren in office, to the temple or hall of the philosopher, in which he and his companions burn incense, pour out libations of wine, chaunt solemn hymns accompanied with instruments, read aloud a panegyric on the memory of Confucius, prostrate themselves before the tablet, and then proceed to feast on the oblations. "These observances bear a marked resemblance to the Roman Catholic ceremony of high-mass; and indeed the whole ritual of the Chinese religion is so similar to that of the church of Rome, that the missionaries of that church were of opinion, that it had been contrived by the devil for their mortification. China.

Though the Chinese have no weekly Sabbath, or any frequently recurring season consecrated to religious purposes; yet they have several annual festivals, which the whole population of the empire joins in celebrating. The most magnificent of these anniversaries is the Feast of the New Year. On the return of the year, all classes of the community have their houses cleaned and decorated, and themselves newly dressed; presents and compliments are exchanged between neighbours and friends; and every one watches his conduct with careful observation, in the belief that whatever he does or says on that day will influence his happiness through the whole year. A universal holiday prevails, and all labour for several days is suspended, during the whole of which all is noise, joy, and festivity. Yet amid all this conviviality, scenes of intemperance and riot are of rare occurrence.

The festival of Lanterns soon succeeds to that of the new year. It begins two days before and lasts two days after the full moon, which first occurs on the commencement of the new year. Every house in the cities, towns, villages, and country, every vessel on the rivers, canals, and coasts, is then in a blaze. The poorest person contrives to contribute his lighted lantern, to increase the effulgence of the general illumination. Transparencies of many a fanciful form, pyramids of party-coloured flame, and incessant vollies of artificial thunder are, in these days, scenes of general exhibition.

Numerous processions are common in China at particular times and for particular purposes. Every rich man, in obedience to the precept in the book of sacred rites, is careful to build a temple to his ancestors, before he build a palace for himself. To these temples, scattered over the country, many processions, composed of all the branches of the family, are made. On these occasions from five to ten thousand persons meet together, when the aged, however poor, always have precedence.

It is common, also, to walk in procession in times of great drought, when clouds of locusts are eating up every green thing, and destroying the hope of the year. Numerous processions take place in autumn, in which a profusion of fruits and flowers are exhibited. And on the occurrence of an eclipse, multitudes walk in procession, offering prayers, and beating on drums. Their superstitious minds recognise a great number of lucky and unlucky days. Nothing of importance must be undertaken on an unlucky day. The roof of every house, in order to be free from danger, must be run in the right direction of the *wind and the water*. Great virtue is supposed to reside in odd numbers. There are three powers, heaven, earth, and man; three lights, the sun, moon, and stars; three relations, a prince and his ministers, a father and his son, a husband and his wife: There are three classes of spirits, celestial, terrestrial, and infernal: Five great virtues, charity, justice, good manners, prudence, and fidelity. They have five elements of nature; five seasons of the year; five primitive colours; five sorts of earth; five degrees of punishment, &c.

The Jews are numerous in China; they are permitted to have synagogues, and enjoy the free exercise of their religion. They abound chiefly in the southern provinces, and are employed for the most part in the manufacture of silk. In the western and north-western provinces there are also many Mahometans. They are said to have entered the empire along with the Tartars, in the thirteenth century, and to have made converts by the purchase of children, and the collection of foundlings, whom they brought up, and instructed in their own tenets.

The Christians of the Nestorian sect came from India into China during the seventh century, and were tolerated by one emperor, and persecuted by another. A number of Christians of the Greek church entered the country like the Mahometans, in the train of Tartars. The Dominican missionaries, along with whom was Marco Polo, to whom Europe was indebted for the first accounts of China, went from Venice to Pekin about the same time, but soon returned to Europe. Towards the middle of the sixteenth century, Francis Xavier arrived at the head of a party of Jesuits in the island of San-shian, on the coast of China. Many other missionaries were afterwards landed in the empire from Italy, Portugal, and France, and recommended themselves to government by their address, and knowledge of the abstract sciences. China has also attracted the attention of the missionary societies of England, and also of the British and Foreign Bible Society; and several books of the Scriptures, both of the Old and New Testaments, have been translated into the Chinese language. But no conjecture can yet be formed of the ultimate result of these exertions, though every friend of human happiness must wish them to prosper.

Peculiar customs.—The entire subjection of children to the will of their parents, which pervades the whole system of Chinese society, ought to be regarded in the light of a religious principle affecting the whole of their social intercourse, and giving a peculiar complexion to their moral character. It is this which gives stability to a government so completely arbitrary, and at the same time so widely extended as to comprehend so many millions under its controul; so meddling in its nature, as to interfere with the minutest circumstances of domestic, and even of personal economy; and so severe in its discipline, as to expose all classes of its subjects to the danger of corporeal chastisement. To the same principle may be traced that ceremonious deportment and unnatural gravity by which they are so remarkably distinguished, and which have given rise to a stiff and a studied behaviour, so that the intercourse of the same family is regulated by a set form of etiquette; and walking abroad, dressing, paying and returning visits, have become a toilsome branch of the duties of life. A magistrate must not indulge in humour, and should maintain a stately silence; he should resemble great bells which seldom strike, and full vessels that give little sound. When officers of state meet, the buttons on their bonnets point out their respective ranks, and inform them of the duties which they owe to each other. The honour which an inferior is obliged to pay to his superior is extremely great; and if he should fail in the observance of it, a bambooing brings him back to a sense of his duty. When one officer of state pays a visit to another, he is preceded by a *card*,—a sheet of red paper folded in a particular manner, by which it is known in what manner he must be received,—at the gate, in the court, or the inner apartment.

Ku-tou.—But the acme of Chinese ceremony is the homage which is paid to the Emperor by all those officers who are admitted into his presence; and which is exacted from all tributary princes, or their representatives, whenever they approach the footstool of the Chinese throne. This homage, which is three prostrations of the body to the ground, three times repeated, is well and shortly described by Bell of Antermony, who accompanied Ismailoff, the Russian embassador to the court of Pekin in 1720. The master of the ceremonies, says he, ordered all the company to kneel, and make obeisance three times to the Emperor. "At every third time we stood up and kneeled again. The master of the ceremonies stood by, and delivered his orders in the Tartar language, by pronouncing the words *bow* and *stand*." The officers of state, who attended the British embassies, under Lords Macartney and Amherst, kindly offered to train them to the performance, which was rejected, on the ground that, as it is understood by the Chinese themselves, it implies an act of worship, and a mark of inferiority, and even of vassalage.

Moral character.—It would, perhaps, be unfair to look for sincerity, candour, or confidence, among people who are always under the influence of so much ceremonious restraint. But the moral qualities of this people are represented not to be of a negative description, but to exhibit many shades and degrees of positive wickedness. They are said to be at once proud and mean, grave, and frivolous, excessively refined, and grossly indelicate; they are accused of jealousy, hypocrisy, and falsehood; of bitter malice and vindictive tempers. With them suicide is no crime; and it is regarded as a favour to a condemned criminal, to allow him to be his own executioner.

As redeeming features of their character, the Chinese are almost universally sober, mild, and affable in their manners, of industrious habits, and submissive dispositions.

History.—The Chinese, in common with almost every other people, lay claim to a very remote antiquity; in proof of which the monosyllabic nature of their oral, and the hieroglyphic character of their written language; the state of civilization, of the arts, and of the sciences, to which they had attained when first visited by Europeans; the stationary condition, in which they have since continued; the stability, organization, and admirable efficiency of their government; and the peculiar cast of most of their manners and customs, (to say nothing of their physical singularities,) exhibit a body of evidence which it is impossible for subtilty itself to invalidate, though it may succeed in withdrawing the attention from its consideration. Yet, the ancient existence of the empire has been a subject of the keenest contention between disputants of the highest celebrity. Voltaire and Raynal, with some of their disciples, have ascribed an antiquity, a character, and a degree of civilization to this people, utterly irreconcileable with the state and progress of man described in the first books of the Bible. And in evidence of their allegations, they have appealed to a long series of eclipses accurately calculated for thousands of years before the Christian era. But the Chinese have no historical records of an earlier date than those collections of annals which were made by Confucius; none of which contradict, but rather confirm the statements of Scripture. It is also a well known fact, that the Chinese learned the calculation of eclipses from the Jesuits, who have presided over the board of mathematics in China for more than two hundred years. The evidence, therefore, for the long duration of the empire derived from this source, amounts to nothing.

The origin of this people has, by different writers, been traced to Egypt, India, Palestine, Greece, and Tartary; while Cuvier is "tempted to suspect, that at the grand *catachyma*, or universal deluge, their ancestors and ours must have escaped the catastrophe at different sides of the globe." But the only probable account of their descent, is that which traces it to Tartary. Their physical character is precisely the same; their moral habits and political principles, their manners and customs, superstitious notions and observances, are not materially different. A Chinese habitation bears a strong resemblance to a Tartar tent; and a Chinese city is nothing more than a Tartar camp. Since the conquest, the Chinese and the Tartars, (though external distinctions still exist,) have in most things coalesced so intimately as almost to have become one and the same people. To account for these coincidences, or features of resemblance, it has been supposed that the first emperor of China was no less a personage than Noah. Those who incline to this opinion maintain that the Ararat of the Scriptures, on which the ark rested, must be sought among the mountains of Tartary, as being the highest ground on the globe; that following the course of the streams which flow from these heights, the patriarch arrived in the province of Chen-see, where he took up his residence, and, under the appellation of Fo-she, became the founder of the Chinese monarchy. This conjecture, however, can neither be verified nor refuted; but it is very probable that the plains of China were first peopled from the regions of Tartary.

The Chinese date the commencement of their history something more than 3000 years before the birth of Christ. A horde of savages with no clothing but skins, without houses or knowledge of fire, and subsisting on the spoils of the chace, on roots and insects, are first described roving among the forests of Chen-see at the foot of the mountains of Tartary. Here, influenced by the authority of Yoo-tson-shee, they settled, and made huts of boughs. Fire, under their next leader, Swee-gin-shee, was discovered by the friction of two sticks. Swee-gin-shee taught his people to look up to the Tien, the creating, preserving, and destroying power, and invented a method of registering time and events by knotted thongs. Fo-hee the third ruler, divided the people into classes, discovered iron, invented the Koua-lines, by the combinations of which calculations are made, appointed religious days, and invented music. He was succeeded by Chin-non, who invented the plough, discovered the method of making salt from sea water, found out by experiments on himself the virtues of simples. Ho-ang-tee, the next emperor, came to the throne when but 12 years old. He is said to have discovered the tendency of the magnet, and thence to have formed an instrument which determined the cardinal points. He is also said to have enlarged the boundaries of the empire, and to have improved its interior. In his reign the Chinese are stated to have made rapid progress in the arts and conveniences of civilized life; and while he was employed in teaching his people to level mountains and make high ways, to build houses and plan cities, his empress shewed them how to breed silk worms, and how to manufacture their cocoons into cloth. The name of Hoangtee is still held in high veneration, and his tomb shewn in the province of Chen-see. On his demise, Chao-hao succeeded to the throne, who is recorded to have ruled with equity, to have reformed the measures of grain, to have cleared the channels of the rivers, and to have instituted many wise and salutary regulations. He named Tchuen-hio his nephew as his successor, to the prejudice of his own sons. But Tchuen-hio, far from distrusting them, raised them to the most honourable employments in the empire. This prince joined the priesthood to the crown, and made a law that none but the emperor should offer sacrifices to the Lord of heaven. He died at a great age, and was succeeded by Ti-co, who was much beloved for the suavity of his manners and the beneficence of his character. He set the first example of polygamy, having married four wives. Tchi, his son and successor, was a prince of profligate conduct, who employed his power to gratify his passions, and was soon, in consequence, obliged to resign the crown to his brother Yao.

The details of this early period of the Chinese history, are said to have been contained in two books called San-fen, and Ou-tien, of which, however, nothing is now known, except a short fragment of the latter inserted at the head of the Shoo-king, an historical compilation made by Confucius, who was the contemporary of Herodotus. The Shoo-king is regarded as authentic history by the Chinese themselves; but as it is obvious that the sage's materials must have been scanty, and often of dubious authority, its details must of course be greatly contaminated with fable.

In the fragment of the Ou-tien already alluded to, as preserved in the Shoo-king, the history of Yao, and of Shun his associate in power, is recorded. Yao is there represented as having been a man of plain and simple habits, of great modesty, virtue, and piety. He is said to have taken great delight in contemplating the motions of the heavenly bodies, and to have been the father of Chinese astronomy. He is also regarded as the first legislator of the nation, and as having established the six tribunals or courts by which the government is still administered. He was powerfully assisted in carrying his beneficial designs into effect, by Yu, his wise and enterprising minister. This man is said to have made great progress in clearing the country of forests, in the formation of canals to drain the marshes, and in the embankment of rivers to confine them within their channels. Yao

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having begun to feel the effects of old age, was considering of a successor who would promote the happiness of his people. But when his own son was suggested to him for that end, he rejected the proposal by saying, *I know that my son, under apparent virtues, conceals real vices.* On the rejection of his son, he offered to prefer his minister to the throne; but he declined the honour, and recommended to the emperor's attention a husbandman named Shun, celebrated for filial obedience and great talents. Shun was forthwith introduced at court, appointed to an office of honour and trust, and in the course of three years, he had acquired a reputation which induced the emperor to make him his son-in-law, and the partner of his power. The colleagues having reigned together in harmony for the space of 28 years, Yao died, leaving with Shun, as his last advice, this important exhortation, *Remember that thou art made for the people, and not the people for thee.* Yao was loved with that tenderness and veneration which children bear to an affectionate parent, and though he lived 118 years, his death was long and sincerely mourned.

When, on this event, Shun came to the full possession of the imperial power, he was honoured with the homage, and enriched with the tribute of the vassal kings; and raised himself to high renown by his wisdom, justice, and clemency. He preferred men of merit and capacity to the offices of government, instituted salutary regulations, and greatly improved the empire. Shun's advancement to the throne is attributed mainly to his exemplary obedience to the commands of his parents, and to his uncomplaining patience under the ill treatment which he suffered from their cruelty and caprice. Whence the Chinese philosophers derive the two great principles of their morality: 1. That children are bound to obey their parents, however wicked may be their characters, and however unreasonable their commands; and, 2. That no man is so wicked whom repeated obligations will not reclaim. Yao and Shun are still regarded in China as models of good sovereigns; and the highest praise which can be conferred on an emperor, is to say that he resembles these excellent colleagues. On the demise of Shun, Yu the minister succeeded to the throne.

1. The imperial power having become hereditary in the family of Yu, he was the founder of the first dynasty, which by the Chinese historians is denominated *Hia* or Kia. This dynasty began about 2200 years before the Christian era, comprehends the period of 450 years, and contains 17 emperors, of many of whom nothing is recorded that merits being remembered. Yu the first is said to have written a treatise on agriculture, to have divided the empire into provinces, to have been easy of access, and much beloved by his people. During the continuance of this dynasty, the country was disturbed by internal insurrections, and the revolt of some of the tributary states. Many of the princes of this family are infamous for their vices; and Kie the last of them being driven from the throne by a prince of the name of Tching-tang, gave rise to the second dynasty called *Chang*.

2. This dynasty comprehends the space of 650 years, and the lives of 28 emperors. Tching-tang, the first of the family, was a prince of ability and virtue. He caused the most useful maxims of morality to be engraved on vessels in common use, that men might thereby be led to the performance of their duty, by having the rules of it constantly before their eyes. In the time of a general calamity arising from drought, he divested himself of his dignity, and fasted and prayed for his subjects. In the reign of Tchong-ting, the 8th emperor of the dynasty, the inundations of the Yellow river obliged him to abandon the province of Chen-see, where the court had hitherto been held, and remove first to Ho-nan, and ultimately to Pe-che-lee. In this reign the southern provinces were overrun by the mountain tribes of the south-west, who were soon subdued. After this, in the reign of Yang-kia, discords arose between the members of the imperial family, and many of the tributary princes revolted from their allegiance; but these evils were retrieved by Pouen-king, the 18th emperor. By the prudence of his conduct, his application to public business, and the vigour of his measures, he soon established good order throughout the empire, and brought the dependant princes to their former obedience and the payment of their usual tribute. This prince changed the name of his family from *Chang* to *Yng*.

3. Tcheoo, the third imperial dynasty, was founded by Voo-vang, who had driven Sin, a cruel and profligate prince, from the throne. This dynasty commenced about 1122 years before Christ, contained a list of 35 emperors, whose reigns comprehended the space of 800 years. During this dynasty, in the reign of Ting-Van, the 21st emperor, Lao-kuen, the founder of the sect called Tao-tse, *Sons of the Immortals*, was born. And in that of Ling-Van, the 23d emperor, the sage Confucius was born, to whom the empire is so deeply indebted. A period of insurrection, anarchy, and confusion arose, by which the family of Tcheoo was deprived of power, and a fourth dynasty, under the name of Tsin, obtained the throne.

4. The fourth dynasty of the empire, distinguished by the name of Tsin, began about two hundred and fifty-five years before the Christian era, and had four emperors in the space of 43 years. The brilliant career of Chi-hoang-tie, the second emperor of this line, has thrown the more ordinary actions of the others entirely into the shade. He destroyed the confederacy which six of the tributary kings had formed against the empire. He planted colonies in the Japan islands, and in the southern side of his dominions. Having observed how much the northern provinces were exposed to the incursions of the roving Tartars, he formed the magnificent design of the great barrier wall, which he is said to have accomplished in the short space of five years. This stupendous pile extends from the sea to the province of Chen-see, a distance of 1500 miles. The boundless ambition of this prince was impatient even of the rivalship of his predecessors, and, to prevent their glory from eclipsing his own, he issued a decree for the entire destruction of all historical records and treatises on the arts and sciences, except what related to physic and architecture. This impolitic edict, which was too faithfully carried into effect by his obsequious servants, has rendered his name odious with posterity. The weakness and wickedness of the two princes of his

China. family by whom he was succeeded, paved the way for a new dynasty.

5. The fifth imperial dynasty, called Han, embraces about 420 years, and contains 25 emperors. It was founded by Licoo-pang, who rose from the rank of a private soldier to the throne, 255 years before Christ. He was a warlike prince, and reduced foreign rebels and domestic rivals to a state of subjection. Ven-tee, the fourth of this line, excited his people to industry, and set them an example of temperance and frugality. He encouraged learning, and patronised learned men. Voo-tee, the sixth in order is also celebrated for the excellence of his character, and the wisdom of his measures. He caused all the fragments of the writings of Confucius, and of the other philosophers and historians which had escaped destruction, to be collected and republished. He is also said to have been of a warlike genius, and to have carried his conquests to Siam, and even to Bengal. But he was superstitiously attached to the sect Tao-tse, and drank frequently, but without effect, the *liquor of life*. Of the 6th, 7th, 8th, 9th, 10th, 11th, 12th, and 13th dynasties nothing important or interesting is recorded. They extend from the 220 to the 905 year of the Christian era, in which period about 60 successive emperors reigned, many of whom were usurpers. During the greater part of this period, the empire was divided into three separate sovereignties, and still more distracted by the convulsions of war. The northern and southern empires, after having continued distinct for almost 300 years, were again united by Ven-tee, a prince of the 12th dynasty. Tay-tsong, the second emperor of the 13th dynasty, is celebrated as a lover of justice and a promoter of learning. In his reign the Nestorian Christians first entered China. The seven succeeding dynasties which comprehend the space between the 907 and the 1333 of the Christian era are equally barren of incident with the seven which precede them. In this period a Tartar tribe that inhabited the country now called Leaong-tong, proved troublesome neighbours to the Chinese. And in the year 1260, Shee-too founded the Yuen, or Mogul dynasty, which consisted of ten successive emperors, all of whom conformed to the Chinese customs, and were distinguished for personal virtues.

21. The 21st dynasty, Ming, extends from 1368 to 1644, A. D. and comprehends the reign of 16 or 18 emperors. The founder of this dynasty was Taitsoo, a wise and politic prince, whose accession to the throne was a source of general joy, both to his own people and the surrounding states. The court was soon after crowded with foreign ambassadors, who came with congratulations and tribute. He established many wise regulations, encouraged industry, and was so great a lover of learning that he assisted in person the examinations for the degree of doctor. In the reign of Chi-tsong, the 11th emperor of this line, the Tartars advanced to the gates of Pekin, with an army, it is said, of 60,000 men, all of which were cut to pieces or made prisoners. In the same reign, A. D. 1552, St Francis Xavier, the apostle of the east, died in an island belonging to the province of Quang-tong.

The origin of the wars with Tartary, which, during the greater part of the continuance of this dynasty, raged with little intermission, has been traced to the unjust treatment which the Tartar merchants experienced from the Chinese mandarins. A Tartar prince is also said to have been trepanned and put to death by them. Tien-ming, the son of this victim of treachery, instigated by revenge, led his countrymen, indignant on account of the injuries their representatives had sustained, into the provinces of China, and, after a series of bloody battles, he assumed the title of Emperor of China, overran a vast extent of territory, and at last obtained possession of the imperial city of Pekin, and commanded the heads of its inhabitants to be shaved, after the Tartar fashion. In these contests the Chinese sought assistance from all quarters, and especially from the Portuguese engineers of Macao, by whom they were instructed in the use of ordnance.

Tien-song, the son and successor of Tien-ming, having been educated in China, and being of course acquainted with their manners and customs, and literature, and being withal a prince of a peaceful and clement character, became extremely popular with the Chinese, while the indolence, ill temper, and tyranny of their own emperor, Hoay-tsong, induced many even of the mandarins to desert his cause, and transfer their services to the Tartar court. In this period of distraction and anarchy, the standard of rebellion was raised in almost every province; royalists of every rank and station were exposed to robbery, indignity, and death; and Lee, the most successful of the insurgents, advanced to the capital at the head of an immense multitude, and drove the emperor from the throne, which he instantly occupied. Oo-san-hoey, the governor of Leao-tong, alone of all the adherents of the Emperor, refused to submit to the usurper Lee. And with the view of driving him from the throne, he called in the aid of the Tartars. On this, Tsong-te, the Tartar chief, and son of Tien-song, joined him with an army of 80,000 men, by whom he was enabled to compel Lee to retire from Pekin. After this event Hong-kuang, the nearest surviving prince of the imperial family, was proclaimed emperor at Nan-kin, and reigned for a while over the nine southern provinces. Tson-te, the Tartar, having, soon after his arrival in China, been seized with a mortal malady, left his son, a child of seven years of age, and the prosecution of his ambitious designs on China, to the charge of his brother, A-ma-van. He proclaimed his nephew, Shee-tsong, the youthful son of his deceased brother, Emperor of China, who was conducted to Pekin in triumph, and welcomed with loud and general acclamations.

22. Thus the crown of China was transferred from the head of their native princes, to that of a race of emperors of Tartar origin. This revolution, for which the Chinese were prepared by a long period of war and bloodshed, took place in the year 1644. Shee-tsong is the founder of the Montchoo Tartar family, which is still on the throne, and which, under the name of Ta-tsin, constitutes the 22d imperial dynasty of the empire.

During the troublous times which preceded this accession of Shee-tsong, the Dominican and Franciscan monks, and the other Christian missionaries, arrived in China.

Shee-tsong found it difficult at first to establish his authority. The sea coast was infested with powerful pirates, who interrupted the commerce of the country; and it required much vigilance, and cost a great deal of blood and treasure, to get rid of the numerous claimants of the crown. By his vigorous and prudent policy he surmounted every opposition, and at last reigned in tranquil security. He chose his ministers from among the Chinese, and not only adhered to the Chinese system of government and law, but adopted their dress, and conformed to their manners. He was a patron of the Jesuits; appointed Adam Schaal president of the board of mathematics, entrusted him with the reformation of the calendar, and honoured him with the appellation of Father. This amiable prince died of grief for the loss of his empress, in the 24th year of his age, and was succeeded by his son Kang-hee, then only eight years of age.

During this emperor's minority, the coast was so much infested with pirates who had taken possession of the island of Formosa, that the Chinese were ordered by government to withdraw three leagues from the sea shore, an edict which destroyed at once the trade and the fisheries of the empire. At the same time various pretenders advanced their claims to the throne by force of arms, all of whom, however, were subdued without much trouble or expence. In the reign of Kang-hee, a terrible earthquake occurred in China, by which 300,000 persons are said to have lost their lives. Many of the temples and towers of Pekin, and of the other cities, were overthrown; and as the shocks continued to be felt for the space of three months, the consternation and the calamity were great and general.

After the Emperor had subdued the fifteen provinces of China, accompanied with a numerous train of attendants, he went into Tartary with the view of visiting the tombs of his ancestors; a custom which he continued annually for the rest of his life. In these expeditions he always had father Verbiest, and some of the other Christian missionaries, in his train; for being a prince of a liberal turn of mind, he was engaged in acquiring from them a knowledge of the sciences. He was in the habit of hearing lectures from them on a variety of subjects twice a-day. By their assistance the boundaries between the Chinese and the Russian dominions were amicably settled in the year 1689. In consequence of these and other services, he granted them many important privileges, and ground, materials, and money to build a church, even within the walls of the palace in Pekin. This church was opened and consecrated in the year 1702. Soon after, in 1707, the missionaries were employed by the Emperor in the arduous task of making a map of the empire from actual surveys. This work, to which the science of geography is so much indebted, was accomplished in the space of ten years. In the year 1720, Peter the Great of Russia sent a splendid embassy to the Emperor of China, an admirable account of which has been given by our countryman, Bell of Antermony, who was in the suite of Ismailoff the embassador.

Kang-hee after he had filled the throne nearly 60 years, was suddenly seized by a mortal distemper while hunting. Perceiving that his end was approaching, he hastily assembled his ministers, and named his fourth son, Yong-tching, as his successor, aud then expired, in the 69th year of his age. He was a prince of a vigorous and penetrating understanding, and of indefatigable application to the affairs of the state. He displayed much wisdom in the choice of his ministers, and exerted an unceasing vigilance over their conduct. And by means of the useful plans, which, for the benefit of his people and the security of the state, it was the business of his life to promote, his memory is still justly revered.

Yong-tching was 45 years of age when he succeeded his father, whose example he followed in the administration of public affairs; and so completely did he hold the reins of government in his own hand, that he ruled with absolute sway, uninfluenced and uncontrouled by his courtiers.

The Christians and their European ministers incurred his displeasure, and in consequence were denied the free exercise of their religion; 300 churches were demolished, or applied to profane purposes; and 300,000 converts were deprived of their pastors. During the sunshine of imperial favour, in which the professors of this faith had basked throughout the former reign, their numbers had become very great, among whom were many of the most illustrious families; all of whom were now degraded from their rank, sent into exile, or punished with death. After this persecution, the Christian religion was tolerated no where in China, except in Pekin and Canton.

In 1736, on the demise of Yong-tching, his son, the celebrated Kien-lung, succeeded to the throne, who, though he had not been named as his successor by his father, was received with acclamation, and continued to maintain his popularity. In the early part of his reign several insurrections were excited among the Tartars, which however were quelled with little difficulty. About the year 1783 the Mahometan tribes, who had been banished to the western mountains, stirred up a more formidable revolt in that quarter, which, after some battles and bloodshed, was also suppressed. On this a barbarous decree was issued to exterminate the race who had dared to rebel, except such as were under 15 years of age, who were ordered to be sold for slaves.

In the year 1793, a British embassy under Lord Macartney repaired to Pekin, with the view of establishing a direct intercourse between China and Great Britain, and of obtaining commercial privileges for the latter—objects which completely failed of success. The Dutch also sent an embassy soon after, with the design of obtaining some advantages for their nation, which failed in like manner.

After a reign of 60 years, Kien-lung resigned the reins of power into the hands of his son Kia-king, who had then attained the mature age of 40 years. Kien-lung was a prince of great capacity, and of many virtues; he died in the year 1799, and in the 89th of his own age. In the interval which has elapsed since his demise, several insurrections are reported to have been excited in the western, and

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even in the southern provinces, which had hopes of overturning the Tartar dynasty.

About the year 1804, Sir George Staunton succeeded in introducing the vaccine inoculation in the populous city of Canton, which, if generally adopted, must prove a great blessing to the dense population of this vast empire; in the meantime a vaccine institution has been established in Canton, and a general inoculation of its inhabitants has taken place.

The misunderstandings which, on various occasions, and on various accounts, arose between the Chinese and the British at Canton, and the consequent difficulty of managing the British trade at that place, suggested the idea of another embassy, which was speedily arranged and sent to Pekin in 1815-16, under Lord Amherst. This mission was still more unsuccessful than that conducted by Lord Macartney. Lord Amherst, because he refused to perform the nine prostrations, was dismissed without being admitted into the imperial presence.

Chiococca || Choriambus.

CHIOCOCCA, a genus of plants belonging to the Pentandria class.

CHIONANTHUS, SNOW-DROP OR FRINGE-TREE, a genus of plants belonging to the Diandria class.

CHIOS, or CHIO, the ancient name of Scio, an island on the coast of Natolia, and opposite to the peninsula of Ionia, was at first under the government of kings, became afterwards subject to the Persians, then fell under the dominion of the Macedonian princes, and was reduced to the form of a Roman province in the time of the emperor Vespasian.

CHIPPENHAM, a town of Wiltshire in England, stands in a fine situation, and contains more than 3400 inhabitants, many of whom are occupied in the manufacture of fine woollen cloths.

CHITON, a genus of shell-fish belonging to the order of *multivalves*. See CONCHOLOGY.

CHIVALRY, which formed a striking feature in the history of European nations during the dark ages, has been characterized as consisting in a passion for arms, in a spirit of enterprise, in the honour of knighthood, in rewards of valour, in splendour of equipages, in romantic ideas of justice, in a passion for adventures, in an eagerness to succour the distressed, in a pride in redressing wrongs and removing grievances, in the courtesy, affability, and gallantry for which those who attached themselves to it were distinguished; and in that character of religion which was deeply imprinted on the minds of all knights, and was essential to their institution. But for an account of the origin and institutions of chivalry, see HERALDRY.

CHLORA, YELLOW CENTAURY, a genus of plants belonging to the Octandria class.

CHLORANTHUS, TEA-LEAVED CHULAN, a genus of plants belonging to the Tetrandria class, some species of which are natives of China and Japan.

CHOCOLATE, a paste which is made up in the form of a roll or cake, and the base of which is *cacao*, or the fruit of *theobroma cacao*, and was employed in infusion as food originally by the Indians, afterwards by the Spaniards, and now by other nations. See BOTANY.

CHORD, a term in music, denoting two or more musical sounds heard together, and constituting harmony.

CHORIAMBUS, in ancient poetry, a foot composed of four syllables, of which the first and last are long and the two in the middle are short, or it consists of a trochaeus and iambus, as nōbĭlĭtās.

Chorus || Christianity.

CHORUS, in dramatic poetry, denotes one or more persons who are present on the stage during the representation, and are supposed to be by-standers, without having any share in the action. In the ancient Greek tragedy, a single chorus only was introduced, singing hymns in honour of Bacchus; an actor was added by Thespis, who relieved the chorus, and rehearsed the adventures of heroes; the poet Æschylus introduced a second actor, and at length the chorus was incorporated with the action or representation.

CHORLEY, a town of Lancashire in England, which stands near the source of the Chor, from which it derives its name, and contains more than 5000 inhabitants, who are chiefly employed in the cotton manufacture.

CHRIST-CHURCH, a market-town of Hampshire, which stands at the confluence of the Avon and Stour, contains more than 1500 inhabitants, who are chiefly employed in the salmon fishery; in two breweries which are established in the place, in knitting stockings, and in making watch-spring-chains. The two latter occupations are confined to women and children.

CHRISTIANA, a sea-port town in the government of Aggerhuus in Norway, stands at the extremity of a bay of the same name, which stretches nearly sixty miles into the interior of the country. This spacious bay is studded with numerous islands which, with the rugged mountains, rising above the surface of the water, exhibit great variety of picturesque scenery. Christiana, which contains a population exceeding 9000, is a regular built elegant town; has several public buildings, some of which are destined to literary institutions, a public library which was founded by a private individual, and a strong castle situated on a rocky elevation on the west side of the bay. The harbour is capacious and convenient, and the trade considerable. The principal exports are iron and copper, tar and soap, planks and deals. The planks which are exported from Christiana are either red or white wood, the first of which is the produce of the Scotch fir, and the last, which is in greatest demand, of the spruce fir. The wood is floated down the rivers from the interior districts of the country, and not fewer than 136 saw-mills are employed in the neighbourhood to cut it into planks and deals. By a regulation of this trade, the number of planks to be cut annually is limited to 20 millions, twelve feet long each, and one-inch and a quarter thick.

CHRISTIANITY, the religion of Christians, or those who believe in the revelation of Jesus Christ. For a view of the evidence of the Christian religion, and of its progress and history, see RELIGION.

CHRISTIANSTADT, a fortified town in the territory of Bleckingen, and province of South Gothland, in Sweden, was built in 1614 by Christian IV. of Denmark whose name it bears, when the province was under the dominion of the Danes, and stands in a marshy plain near the river Helgea, which joins the Baltic at the distance of 20 miles. The houses are of brick, and the town, though small, is regular and well built; the river is only navigable for small craft; pitch, tar, and alum are exported; and some of the inhabitants are occupied in the manufacture of cloth and silk stuffs.

CHRISTINA, queen of Sweden, was the daughter of Gustavus Adolphus; was born in 1626, and succeeded to the throne in 1633, when she was only in her seventh year. Distinguished from her infancy by a strong aversion for the ordinary employments and conversation of women, she was fond of violent exercises, and delighted in amusements in which feats of strength and activity were performed. She seems to have made some progress in the knowledge of languages, and devoted a portion of her time to scientific inquiries, particularly to those of legislation and government. As she grew up, and was the sovereign of a powerful kingdom, she was solicited in marriage by most of the princes of Europe, and particularly by her cousin, Charles Gustavus, duke of Deux-Ponts, of the Bavarian palatinate family; but every solicitation of the kind was rejected, and Charles Gustavus being formally appointed as her successor to the throne, was a proof that it was her fixed resolution to enter into no matrimonial connection.

One of the most important public affairs in which Christina was engaged while she swayed the Swedish sceptre, was the peace of Westphalia; in the negotiations for which her influence had a considerable share in reconciling and settling various discordant interests. No other public event, either from wars abroad or from troubles at home, disturbed her reign, which has been characterised as the reign of learning and genius; for, wherever she resided, she had the address to draw round her the learned men of the time, among whom are enumerated Grotius, Paschal, Bochart, Descartes, Vossius, Bayle, Madam Dacier, and many others; but, like many other patrons of learning, she did not always confer her favours according to the real merit of the object.

It appears that, in the early part of her reign, Christina was fond of the pomp and power of royalty; but, from fickleness of temper, or, it is said, from love of independence, she became embarrassed and disgusted with the restraints and duties of sovereignty, and came at last to the final determination of abdicating the throne. In the year 1654, after a reign of about 20 years, she carried her design into execution. The ceremony of her abdication is described as a mournful solemnity, a mixture of pomp and sadness, in which few eyes but her own were not filled with tears; but she retained her composure, and as soon as the ceremony was over, she prepared to remove from Sweden. Having now abdicated her crown, when she reached Brussels she abjured her religion, and professed herself to be a member of the church of Rome. From Brussels she removed to Rome, and in the remaining period of her long life she afforded ample proof of her restless and unsteady disposition, for she was constantly changing the place of her residence. Rome, France, Hamburgh, and Sweden, were at different times selected for her place of abode, and at last she died at Rome in 1689.

The character of this princess exhibits a singular mixture of faults and great qualities. It is admitted that she had wit, taste, parts, and learning; that she was indefatigable on the throne, great in private life, and firm in misfortune; but she was impatient of contradiction, and, excepting in a love of letters, inconstant in her inclinations. In all her actions and pursuits she was violent and ardent; impetuous in her desires, and dreadful and severe in her resentments.

CHRISTMAS-DAY, a festival observed by most Christian churches on the 25th of December, in memory of the nativity of Jesus Christ. The origin of this festival is traced to the second century, although from other documents it appears to have been celebrated at an earlier period. The observance of Christmas in the time of Dioclesian is fully established by the cruel and barbarous act of that emperor, who ordered the church doors, in which the Christians were assembled for that service, to be shut, and the edifice to be set on fire, by which they were all destroyed.

CHRISTOPHERS, ST. an island in the West Indies, and geographically arranged with those which come under the denomination of Caribbee islands; is about 60 miles to the westward of Antigua, and is about 15 miles in length, and four in breadth. The central districts are mountainous and rugged, and clothed with thick woods, and the cultivated productions are sugar, cotton, ginger, indigo, with the various fruits of tropical climates.

This island is divided into nine parishes, and contains four towns and hamlets. Basseterre is the capital of the island, and consists of about 800 houses. The whole number of white inhabitants in the island is stated at 8000, and the number of negroes at 26,000, beside 300 free persons of colour.

CHROMATICS, is that part of Optics which relates to the several properties of the colours of light. See OPTICS.

CHRONIC, or CHRONICAL, is a term employed by medical writers, for the denomination of those diseases which have a protracted duration, in opposition to such as prevail only for a short time, and are called *acute*.

CHRONICLE, a historical composition, in which the detail of events is arranged according to the order of time in which they happened, and is in a great measure analogous to *annals*.

CHRONICLE, PARIAN, the denomination of the inscriptions on the *Arundelian Marbles*, which derived their first name from having been executed in the island of *Paros*, as some have supposed, and the last from the *Earl of Arundel*, at whose expence these ancient monuments were collected; and being now deposited at Oxford, they are also known by the appellation of the *Oxford Marbles*. No subject has been a more fruitful source of controversy among the learned; for while some alleged that doubts may be entertained of their authenticity, others assert that they are entitled to the claim of the highest antiquity. See ARUNDELIAN MARBLES.

CHRONICLES, BOOKS OF, are canonical writings of the Old Testament, containing an abridgement of the sacred history of the Jews, from the beginning of their nation to the year of their return from the Babylonish captivity.

CHRONOLOGY, derived from the Greek, and literally signifying a discourse on time, is the method of measuring time, and of adjusting its several divisions; but in a more extended sense it is applied to the method of fixing the dates of the various events recorded in history, and of arranging them in the order in which they took place. See HISTORY.

CHRONOMETER, a measurer of time, denotes any instrument or apparatus which is employed for that purpose, as dials, clocks, and watches; but in a more limited sense it is applied to clocks or watches which are constructed with great accuracy, and are susceptible of measuring very small portions of time. Such instruments have been long the objects of mechanical ingenuity, and in this country, where they are of so much importance in navigation, they have been brought, under the sanction and liberal encouragement of Parliament, to a high degree of perfection. See HOROLOGY.

CHRYSALIS, is one of the stages of existence through which insects pass, and is so called from the hard or crustaceous covering having the appearance of gold, or being studded with golden spots; and for the same reason it is also denominated *aurelia*. The state of chrysalis during which the insect remains dormant, precedes its appearance in the perfect form. See ENTOMOLOGY.

CHRYSANTHEMUM, CORN-MARYGOLD, or OX-EYE DAISY, a genus of plants belonging to the Syngenesia class. See BOTANY.

CHRYSIS, GOLDEN-FLY, a genus of insects belonging to the *Hymenoptera* order. See ENTOMOLOGY.

CHRYSOBALANUS, COCOA-PLUM, a genus of plants belonging to the Icosandria class.

CHRYSOCOMA, GOLDY-LOCKS, a genus of plants belonging to the Syngenesia class.

CHRYSOLITE, a mineral substance belonging to the *Siliceous* genus. See GEOLOGY.

CHRYSOMELA, a genus of insects belonging to the Coleoptera order. See ENTOMOLOGY.

CHRYSOPHYLLUM, STAR-APPLE and BULLY-TREE, a genus of plants belonging to the Pentandria class, of which the species *cainito* furnishes one of the richest tropical fruits.

CHRYSOSPLENIUM, GOLDEN SAXIFRAGE, a genus of plants belonging to the Decandria class, and including two species, both of which are natives of Britain.

CHRYSOSTOM, ST JOHN, patriarch of Constantinople, and one of the most eminent fathers of the Christian church, was descended from a noble family at Antioch, and was born about the year 347. Having studied rhetoric and philosophy, he retired into solitude, and subjected himself for some time to privations and austerities; was afterwards ordained deacon of Antioch, and acquired so high a reputation for eloquence that he was distinguished by the surname of *Golden-mouth*. In 397 he was elevated to the patriarchate of Constantinople; and in the succeeding year he was ordained bishop, when, with great zeal he commenced his labours in the reformation of the abuses which prevailed among the clergy, and reduced his expenditure, that he might apply a larger portion of his revenues to charitable purposes. But his sermons and admonitions against the vices of the age raised up against him powerful enemies, through whose influence he was deposed and banished. In a short time he was recalled, but his freedom of speech brought down a similar sentence upon him; and he died in 407, while on the road to the place of his exile, a barren region of Armenia. An edition of the works of Chrysostom was published, under the superintendence of Montfaucon, at Paris, in 1718.

CHURCH, a term which is employed in different senses, as in its most extensive signification denoting the collective body of Christians, and thence denominated the Catholic, or Universal Church; or applied to a particular congregation of Christians, who associate together, and observe the institutions of Christ, with their proper pastors and ministers, as the church of Antioch, the church of Alexandria, and the church of Thessalonica; or it denotes a particular sect of Christians, distinguished by particular doctrines and ceremonies, as the Romish church, the Greek church, the reformed church, the church of England; or it signifies the body of ecclesiastics, or the clergy in opposition to the laity; or is applied to the place where a particular congregation or society of Christians assemble for divine service,—and in this sense it is often distinguished by a descriptive epithet, as metropolitan church, cathedral church, parochial church.

CHURCHILL, JOHN, DUKE OF MARLBOROUGH, a celebrated general and statesman, was born at Ashe, in Devonshire, in the year 1650, and was the eldest son of Sir Winston Churchill, who supported the royal cause in the time of Charles I. and held some public appointments in the reign of Charles II. The father's connection with the court was the means of an early introduction to the son, who, in his 12th year, was favourably received by the Duke of York, afterwards James II. His first military appointment was in 1666, when he was nominated to an ensigncy in the Guards, and was engaged in active service during the first Dutch war. In 1672 he accompanied the Duke of Monmouth, who commanded a body of auxiliaries in the French service; and at the siege of Nimeguen, which happened in the same campaign, he distinguished himself so much by his valour and conduct as to attract the notice of the celebrated Marshal Turenne, and, on account of his elegant figure, obtained from that renowned general the flattering appellation of the *handsome Englishman*. The siege of Maestricht, which took place in the succeeding year, afforded Churchill another opportunity of displaying his bravery and military skill, and procured for him not only the acknowledgment of his own

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sovereign, but the marked approbation of the king of France.

In 1681 his influence was probably strengthened by his marriage with Miss Jennings, who was in great favour with Queen Anne, and as Sarah, Duchess of Marlborough, made a conspicuous figure in the history of the English court during that period. At the recommendation of the Duke of York he was raised to the peerage in the following year, with the title of Baron of Eyemouth, in Berwickshire, in Scotland, and at the same time promoted to the command of a troop of guards. Soon after the accession of King James, he was created Baron Churchill of Sandrich, in Hertfordshire, and raised to the rank of brigadier-general of the king's army in the west, which it is admitted he saved when it was surprised by the sudden approach of the Duke of Monmouth.

From prudent policy, or from religious scruples, Lord Churchill abandoned the cause of his royal master, to whom he was under the greatest obligations, when his strong bias in favour of the Roman Catholic religion diminished his popular influence, and finally deprived him of his crown. This step led the way to new honours; he was well received by the Prince of Orange, was employed to new model the army, raised to the rank of lieutenant-general, and soon after to the dignity of Earl of Marlborough. As commander in chief of the English forces in Holland, he laid the foundation of that fame which afterwards spread over all Europe. In 1690, being appointed general of the forces in Ireland, he reduced the strong garrisons of Cork and Kinsale, and made the troops prisoners. In the following year, he was sent to Flanders to arrange the army, and to prepare it for active service before the arrival of the king.

But in 1692, the Earl of Marlborough experienced one of those reverses from which the acutest foresight, and the greatest prudence, cannot secure the favourites of a court. He was stripped of all his employments, and soon after was committed to the Tower, along with some other peers, on a charge of high treason. When this charge was investigated, it was pronounced to be false and malicious, and Marlborough was again restored to royal favour. In 1698 he was appointed governor to the Earl of Gloucester, King William's nephew, admitted to a seat in the privy council, and nominated one of the Lords Justices of England, for the administration of the government during the King's absence.

The accession of Queen Anne to the throne proved no diminution to his honours and employments. He was appointed captain-general of all her Majesty's forces, and sent ambassador extraordinary and plenipotentiary to Holland; and after numerous conferences, when a vigorous prosecution of the war was determined on, he was placed at the head of the army, and his achievements in the field form some of the most brilliant events which the page of history records. But the detail of these events, which is more closely connected with history than with biography, will be found in that period of the history of Britain. After his first campaign, he was created Marquis of Blandford, and Duke of Marlborough, with a pension of L.5000 out of the revenues of the post-office, which was to devolve in perpetuity upon those who possessed the title of Duke of Marlborough. The splendour of his victories procured for him costly presents, and the highest congratulations from almost all the potentates of Europe; and after the battle of Blenheim, in 1704, the manor of Woodstock was conferred upon him by his sovereign; and the princely pile which was erected upon it, at the expence of the nation, was destined to remain as a public monument of the gratitude of the country for his military services.

But the essential services which he had performed, and the high honours which he had attained, with all the influence and power with which such honours are usually associated, could not support his declining interest after the change of ministry in 1710, and in 1712 he was removed from all the places of trust and emolument which he had enjoyed. During the period of his disgrace, he retired to Germany, and only returned to England on the very day of the Queen's death, in hopes, probably, of again reposing in the sunshine of royal favour. He was not disappointed, for after receiving the congratulations of the nobility and foreign ministers, he attended George I. in his public entry into London, and was again restored to the highest honours and offices. For several years before his death, the Duke of Marlborough had retired from all public business, and he died in 1722, when he had reached the 73d year of his age.

Of the character of the Duke of Marlborough various estimates have been made, as they were drawn up by the hand of a friend and admirer, or by those who were envious of his reputation, and disposed to darken his fame. Lord Bolingbroke, in allusion to the consternation which the death of King William excited among the allies of the grand confederacy, and the joy which the French displayed at the same event, says, that "a short time shewed how vain the fears of some and the hopes of others were. By his death, the Duke of Marlborough was raised to the head of the army, and, indeed, of the confederacy, where he, a new, a private man, a subject, acquired by merit, and by management, a more decided influence than high birth, confirmed authority, and even the crown of great Britain, had given to King William. Not only all the parts of that vast machine, the grand alliance, were kept more compact and entire, but a more rapid and vigorous motion was given to the whole; and instead of languishing out disastrous campaigns, we saw every scene of the war full of action. All those wherein he appeared, and many of those wherein he was not then an actor, but abettor, however, of their actions, were crowned with the most triumphant success. I take, with pleasure, this opportunity of doing justice to that great man whose faults I knew, whose virtues I admired, and whose memory, as the greatest general, and as the greatest minister that our country, or perhaps any other has produced, I honour." But as a contrast to this high eulogium, it must be stated, that he has been charged with avarice, which it is said he practised even to a degree of meanness. Even at an early age, a report was in circulation that he purchased a box to keep his money; and when he was at the head of armies, and on the eve of an important battle, he found fault with his servant for being so extravagant as to light four candles in his tent when Prince Eugene came to confer with him; and it is recorded by Swift, that when he told the Queen that he was neither covetous nor ambitious, she said that she could not help smiling in his face. But with all the elegance and gracefulness of his person and manners, to which so much of his good fortune and eminent success has been ascribed, it cannot be doubted, that one who had so large a share in the political events of the times, and who achieved so much by his military prowess, possessed an excellent understanding and a sound judgment.

It is not a little singular, that the surviving friends of this illustrious general, even with the encouragement of a liberal remuneration, altogether failed in procuring a biographical sketch unconnected with the history of the times. Of this circumstance, Dr Johnson, in his life of Mallet, has observed, that "the long retardation of the life of the Duke of Marlborough shews, with strong conviction, how little confidence can be placed in posthumous fame. But when he died, it was soon determined that his story should be delivered to posterity; and the papers supposed to contain the necessary information, were delivered to Lord Molesworth, who had been his favourite in Flanders. When Molesworth died, the same papers were transferred with the same design to Sir Richard Steele, who, in some of his exigencies, put them in pawn. They remained with the old Duchess, who, in her will, assigned the task to Glover and Mallet, with the reward of L.1000, and a prohibition to insert any verses. Glover rejected, I suppose, with disdain, the legacy, and devolved the whole work upon Mallet, who had from the late Duke of Marlborough a pension to promote his industry, and who talked of the discoveries which he had made; but left not, when he died, any historical papers behind him."

CHURCHILL, Charles, a satirical poet, was the son of a clergyman in Westminster, and was born in the year 1731; in his eighth year entered Westminster school, in which he received more applause for his capacity than diligence; and after being rejected when he applied for matriculation at Oxford, for some reason which is not explained, he was admitted a student at the university of Cambridge. He was now in his 19th year, but seems not to have improved his habits of application; for instead of returning to prosecute his studies, he privately formed a matrimonial connection in London; and having no means to support himself or his wife, he was again admitted under the roof of his father, and was for some time assiduous in qualifying himself for the clerical profession. Having received deacon's orders, and being ordained a priest in 1756, he first officiated in Somersetshire, and afterwards at Rainham, in Essex, of which place his father was rector; and, to add to his slender income, he employed his leisure hours in teaching the youth of the neighbourhood. In 1758, on his father's death, he was appointed curate and lecturer of the parish of St John the Evangelist, in Westminster, and beside the business of tuition, which he continued, he performed his official duties for some time with propriety and decency; but the correctness and regularity of his conduct were not of long duration; his industry relapsed, and his habits of dissipation involved him in pecuniary embarassments, from which he was relieved by the kind interference of Mr Lloyd, the father of his friend, the poet, and one of the masters of Westminster school. His creditors accepted a composition, and granted him a release; and whatever stain the profligacy of his manners has left on his character, it ought to be recorded to his honour, that he discharged the whole amount of his debts from the first fruits of his literary labours.

The first poetical productions of Churchill seem to have attracted little notice. The *Rosciad*, which was published in 1761, and the *Apology*, which soon followed as a satire on the critical reviewers, were more successful, and brought him both reputation and emolument. Unfortunately his immorality increased with his literary fame; and became so offensive to his parishioners and the superior clergy, that the poet, despising reproof, abandoned the clerical profession, and indeed threw off all the restraints of external decorum. His poem called *Night*, which appeared about this time, may be considered as an apology for folly and immorality. His next poem, the *Ghost*, which was published in 1762, is intended as a satire on Dr Johnson, who, it seems, had not expressed that approbation of the author's writings which he wished or expected.

The acquaintance of Churchill with the celebrated John Wilkes is supposed to have commenced about this time, and to have led to the composition of his *Prophecy of Famine*, which, with some humour, and much virulence and scurrility, acquired great popularity. The other poems of Churchill are, his *Epistle to Hogarth* in which, with little credit to himself, he attacks the age and infirmity of the satirical painter, *the Author*, *Gotham*, *the Duellist*, *the Candidate*, *the Times*, and *Independence*.

While on a visit to his friend Wilkes, at Boulogne in France, Churchill was seized with a fever, which brought his short life to a close, when he had only reached the 34th year of his age. Of the propriety of the inscription on his tomb,

"Life to the last enjoyed, here Churchill lies."

very different opinions, it is presumed, will be formed by those who consider the dissipated course of the poet during his mortal career.

Churchill was not destitute of genius; his poems, which were of a temporary character, and intended to serve a particular purpose, are now little read, and perhaps less admired; and the nature and fate of his literary productions afford an instructive lesson, that even the best talents require diligent and careful cultivation.

CHURNING, the operation by which butter is separated from milk. See Agriculture and Chemistry.

CHYLE, a milky fluid, which is separated by the digestive organs from the food taken into the stomach and destined for the nourishment of the body. See Anatomy and Chemistry.

CIBBER, Colley, a celebrated actor and dramatic writer, was born in London in 1671. His fa-

Ciber.

ther was a native of Holstein, and by profession a sculptor, in which he acquired no small degree of reputation by the basso-relievo which he executed on the pedestal of the Monument in London, and the figures of raving and melancholy madness on the piers of the gate of Bethlehem hospital. In his 11th year he entered the free school of Grantham in Lincolnshire; and having spent seven years in that seminary, and being disappointed of admission into Westminster college, he had directed his views to the clerical profession, when his father having taken an active part in the cause of the Prince of Orange, he joined the same standard, and continued for some time to perform the active duties of the military life.

When he had finished his short warfare, and procured his discharge, he became strongly attached to theatrical exhibitions, and in the year 1689 he appeared upon the stage; but neither his person nor his voice seemed to promise much success in his dramatic exertions. He was at first employed in the lowest characters, and with a weekly salary of 10s. only. The accident of another performer being taken suddenly ill, brought him forward in a character of a higher cast, and procured for him the approbation of Mr Congreve, and at the same time an increase of his salary to double the amount. His performances on the stage now continued to increase his fame; and his first production, *Love's Last Shift, or the Fool of Fashion,* which appeared in 1696, raised him high in the public estimation as a dramatic writer. Two other plays, which successively followed, were unfavourably received; but *The Careless Husband*, which was first acted in 1704, was esteemed his best comedy, and has been greatly admired.

Having been for some years conjunct-manager, and one of the patentees of Drury-lane theatre, Cibber, availing himself of the spirit which prevailed, and which burst out into the flames of civil war in 1715, produced his comedy of *The Nonjurors*; the satire of which being directed against the Jacobites, was hailed with applause by the opposite party; and, besides its extraordinary success on the stage, procured for him a pension of L.200 from the king, and the office of poet-laureat.

The *Apology for his Life* appeared in 1740, a work which exhibits the theatrical history of his own time in a lively and characteristic manner. In 1745, while he was in the 75th year of his age, he appeared on the stage, and acted with great applause the character of the *Pope's Legate* in the tragedy of *Papal Tyranny*, composed by himself. He lived to the advanced age of 87, and died in 1757. Beside twenty-five dramatic productions, Cibber was the author of Two Letters to Pope; the Apology for his Life, already mentioned, and *Remarks on Middleton's Life of Cicero.* Some of his plays still retain their character in public estimation, and are occasionally brought forward on the stage.

CICADA, the Frog-hopper, or Flea-locust, a genus of insects belonging to the order Hemiptera. See Entomology.

CICCA, a genus of plants belonging to the Monoecia class.

CICER, Chick-pea, a genus of plants belonging to the Diadelphia class, and including only one species, *arietinum*, a native of the Levant, and of the southern parts of Europe.

Cicero.

CICERO, Marcus Tullius, the celebrated Roman orator, descended from an ancient family of the equestrian order, was born in the 647th year of Rome, and about 105 years before the Christian era. The birth-place of Cicero was in the vicinity of Arpinum in the Neapolitan territory; and the same spot was lately occupied by a convent of monks. His first name, *Marcus*, was derived from his father; *Tullius* was the family name; and *Cicero*, the second family-name, is supposed to have arisen from the employment of his ancestors, who were occupied in the cultivation of vetches.

Having completed the early part of his education under a matron, as was the Roman custom, Cicero, at the proper age, was placed at a public-school in Rome, where he distinguished himself above all his fellows; and under the poet Archias, who was one of his instructors, he made an unsuccessful effort in poetical composition. Being introduced to the forum, under the patronage of Quintus Curtius Scævola, the first lawyer of the time, his professional pursuits were soon interrupted by the civil dissensions which then disturbed the state, and for a short time he performed the duties of active warfare. On his return to Rome, he resumed his philosophical and rhetorical studies, and published some original works, and translations from the Greek, more or less remotely connected with the profession which he was now destined to practise. In his 26th year he acquired great reputation in pleading his first cause, and distinguished himself not less by the splendour and impressive effects of his eloquence, than by his humanity in a case of peculiar oppression and by his intrepidity in exposing himself to the tyranny which then prevailed.

Cicero visited Greece in his 28th year; and at Athens, and other places where he resided, made himself master of the Greek philosophy, with the details of which most of his works are copiously enriched. But, with the view to qualify himself for his own profession, he was not unmindful of the study of oratory, both during his two years absence and after his return to Rome, and soon rose to the first rank of Roman orators.

Aspiring to the honours and offices of the state, Cicero was chosen one of the quæstors, and was appointed to Sicily, where his moderation and management of the public revenues obtained for him the gratitude and good wishes of the inhabitants. During his residence in that island, with a laudable curiosity, he made inquiries for the tomb of the celebrated philosopher Archimedes; but no one being able to direct him to the spot, he prosecuted his researches, and, in a place overgrown with brushwood and briars, he discovered the mutilated column on which were sculptured the sphere and cylinder. When the period of his quæstorship had expired, he was elected, on his return to Rome, one of the ædiles, or police-magistrates, to whose superintendence were assigned the care of the public buildings, the inspection of the markets, weights and measures, and the regulation of public shews and festivals. About the same time he was engaged by the Sicilians to accuse Verres for oppression and injustice; and such was the effect of the oration which he delivered on that occasion, that the accused, without waiting for a judicial decision, became a voluntary exile. In the fulfilment of his magisterial duties, it was necessary to indulge the people in public festivals, for which the Romans had a strong passion; and as the allowance from the public revenue was small, a large share of the expence fell on the magistrate who was desirous of securing the favour of the people. His friends, the Sicilians, afforded him, in these circumstances, the most substantial proofs of the grateful recollection of his services, by an abundant supply of all kinds of provisions for the use of his table and the public feasts. But here the generosity of Cicero was conspicuous, in refusing to take advantage of their liberal conduct for his own private use. He applied the whole to the benefit of the poor, and at the same time increased his popularity.

Two years having elapsed from the time that he was chosen ædile, which was the period prescribed by law, he offered himself a candidate for the prætorship; and having succeeded in attaining that object of his ambition, he began now to look forward to the consulship; and keeping this in view, he declined to accept of the government of any foreign province, which was the usual reward of that magistracy. At last, in his 43d year, he rose to the summit of his ambition, by being chosen consul. The first struggle which he had to encounter when he entered upon his office, was in defeating the intrigues of the tribunes, who at this time had acquired great influence as popular leaders, but in the suppression of the Catiline conspiracy, which was formed for the subversion of the commonwealth, the prudence and talents of Cicero were still more conspicuous, and for this important service he obtained the high and honourable appellation of *Father of his Country.*

Cicero had married, it is supposed, his wife Terentia about the time of his return from Greece, and when he was about thirty years old. On the expiration of his consulship, he seems to have aimed at living in the greatest splendour; for he purchased one of the finest houses in Rome, and which cost, it is said, L.30,000. This circumstance seems to have excited some censure on his vanity, or roused some suspicions of the real object of his views, for, in allusion to it, he says himself that he was now plunged so deeply in debt as to be ready for a plot, only that the conspirators would not trust him.

The affair of Clodius formed a remarkable era in the life of Cicero. Clodius had been guilty of a violation of those religious mysteries to which females only are admitted, and the evidence of Cicero defeated the attempt which Clodius made to prove his absence at the time he was charged with the violation of the sacred rights. The resentment of Clodius was soon interwoven with the political intrigues and dissensions which at the time prevailed among the principal leaders of the Roman people. The talents and influence of Cicero seem to have been regarded with jealousy and suspicion by all parties, who either united against him, or at least connived at the calamity which was ready to befal him. Clodius at last succeeded in executing the plot which he had contrived for the ruin of the object of his resentment; Cicero was banished by the votes of the people, and was commanded to remove at least 400 miles distant from Italy; his magnificent mansion was demolished, and his goods were exposed to sale. In the midst of this severe calamity, it is to be regretted that Cicero exhibits none of that tranquillity and resignation which he so forcibly recommends, and so finely illustrates in his works. Two months only had elapsed, when it was proposed in the senate that he should be recalled. After some opposition, the motion was carried; and his return to Rome, and restoration to his former dignity, resembled the pomp and splendour of a triumph.

While Cicero was in the 56th year of his age, he was appointed pro-consul of Cilicia, and he acquired great honour to himself by his administration of the affairs of that province. The breach between Pompey and Caesar was now approaching, and an affair which was to involve the republic in all the horrors of civil war could not be contemplated by Cicero with indifference. The rival competitors, Cæsar and Pompey, were each anxious to gain Cicero to his own interest. He at last joined the cause of Pompey; and yet after the battle of Pharsalia, in which Pompey was defeated, he was received into favour by Cæsar,—a sufficient proof how much his talents and influence were respected by the conqueror.

The domestic tranquillity of Cicero, when he had reached the 61st year of his age, was not a little disturbed by being obliged to divorce his wife, Terentia, whose violent temper and capricious humour had long harrassed him, and this event was followed by another affliction in the death of his daughter Julia, who was greatly distinguished among the Roman ladies by her solid learning and elegant accomplishments. The grief which he suffered for her loss drove him into retirement, and although he was not an indifferent spectator of public affairs, both during the administration of Cæsar and for some time after the death of the dictator, yet he seems to have been deeply engaged in his philosophical investigations.

In the famous league which was formed by Octavius, Antony, and Lepidus, for dividing the power and provinces of Italy among themselves, Cicero was included among the proscribed citizens, whose destruction seemed necessary to gratify individual resentment or to facilitate the attainment of their ambitious views. Cicero's friends, aware of his danger, warned him to withdraw from his impending fate; he went on board a ship, but the adverse winds kept him on the coast, and when night approached he again landed. By the importunity of his servants, he was again forced on board, and having remained some time, felt himself greatly incommoded under the privations and difficulties of a sea voyage, and went on shore again to a country seat of his own, his Formian villa, situated about a mile distant from the coast, and at the same time he declared that he was determined to die in that country which he had so often saved. Having spent several hours in undisturbed repose, he was again forced into a litter by his servants, and conveyed to the ship through the private walks of a wood. They had scarcely left the house, when the ministers of vengeance, thirsting for his blood, arrived; they were headed by Popilius Læнas, a tribune of the army, whose life Cicero had formerly defended and saved. His murderers pursued and overtook him in the wood, and although his servants prepared to defend him at the risk of their lives, Cicero commanded them to forego all resistance, and with a firm deportment submitted to his fate. Not satisfied merely with depriving him of life, with a brutal revenge they mutilated the body of the patriotic orator; the head and hands were conveyed to Rome and presented to Antony, who ordered them to be fixed upon the rostra, where they exhibited a melancholy spectacle, which drew tears from all those virtuous citizens who had witnessed his exertions in defence of the lives and liberties of the Roman people.

Cicero met his fate in the 64th year of his age. The death of others in that period of proscription, it has been remarked by a historian of the same age, caused only a private and particular sorrow, but the death of Cicero excited universal lamentation; for it was a triumph over the republic itself, and seemed to confirm and establish the perpetual slavery of Rome. The character of Cicero as an orator, a philosopher, and a patriot, has been variously estimated, for a view of which, the reader may consult his *Life by Middleton.*

CICHORIUM, SUCCORY, a genus of plants belonging to the Syngenesia class, and of which one species, *cichorium intybus*, is cultivated as food for cattle, and another species is the *endive* of the kitchen garden.

CICINDELA, the SPARKLER, a genus of insects belonging to the order of Coleoptera. See ENTOMOLOGY.

CICUTA, HEMLOCK, a genus of plants belonging to the Pentandria class, and of which one species, *cicuta virosa*, is a deadly poison. See BOTANY.

CILICIA, an ancient kingdom of Asia Minor, lying between the 36th and 40th degree of north latitude, and having for its boundaries Syria on the east, Cappadocia and Armenia Minor on the north, Pamphylia on the west, and the Mediterranean sea on the south. This district is surrounded by precipitous mountains, which form a strong defence, and admit of an approach only by three passes, of which the pass of the celebrated mount Taurus is one. These passes have been called the gates of Cilicia. This region is divided, as it was also in ancient times, from its natural aspect, into the rugged and plain or Champagne district, and to this day it is called the *stony province.* It was first peopled, according to Josephus, by Tarshish, the son of Javan, and his descendants, from which the whole country is called Tarsis. The chief city was distinguished by the same name, and is now called Tarasso; it stands upon the river Cydnus, was memorable in ancient times as the rival of Athens for arts and civilization, and merits notice as the birth place of the apostle Paul.

Cilicia was subject to those changes and revolutions which were the consequences of the contests between the Greeks and Persians; in the triumphant progress of the Roman arms in the east, it became a province of that power, and now forms part of the Turkish province of Caramania. The eastern district, which is flat, is fertile in grain and fruits, and the mountainous tract on the west is celebrated for its excellent breed of horses.

CIMBRI, an ancient nation of the northern parts of Germany, said to have been descended from the Cimmerii of Asia, and, being a warlike people, became powerful antagonists to the Roman power, and even, at one time, threatened the city itself with invasion.

CIMEX, a genus of insects belonging to the order Hemiptera, one species of which, common housebug, *cimex lectularius*, is often the most troublesome inmate to the habitations of man. One of the best methods of preserving furniture from being infested with these insects, is to wash those parts of it in which they lodge with oil of turpentine in which camphor is dissolved.

CINARA, or CYNARA, the ARTICHOKE, a genus of plants belonging to the Syngenesia class.

CINCHONA, a genus of plants belonging to the class Pentandria, several species of which yield the celebrated Peruvian, or Jesuit's bark, so extensively employed in medicine. See BOTANY and MATERIA MEDICA.

CINERARIA, a genus of plants belonging to the class Syngenesia.

CINNABAR, a native ore or sulphuret of mercury; and the same name is applied to the artificial compound, which is well known for the brilliancy of its colour, and is employed as a pigment. See CHEMISTRY, and MINERALOGY under GEOLOGY.

CINNAMON is the well known and grateful spice obtained from the bark of the *laurus cinnamomum*, a tree which is carefully cultivated in the Spice islands, and in Ceylon in the East Indies, and of late years in some of the West India islands. See BOTANY and MATERIA MEDICA.

CINQUE-PORTS, are five sea-port towns on the eastern coast of England, which, on account of their importance, enjoy peculiar privileges, are regulated by particular municipal laws, and are governed by a keeper called *Lord Warden of the Cinque-ports*, who it is said was first appointed by William the Conqueror. But they derived their chief privileges from King John, on condition of furnishing him with 80 ships while engaged in war with France, and at their own expence. The five ports are Hastings, Romney, Hythe, Dover, and Sandwich.

CIRCÆA, ENCHANTER'S NIGHT SHADE, a genus of plants belonging to the Diandria class. See BOTANY.

CIRCARS, NORTHERN, an extensive province of India, and stretching along the west side of the bay of Bengal, from the 15° to the 20° of north latitude, and belonging partly to the Deccan and partly to Orissa; bounded on the east by the sea along a coast of 470 miles from its southern extremity to the borders of the Chilka lake, and divided from the province of Hyderabad by a range of detached hills that extend to the banks of the Godavery, and to the north of that river separated from Berar by a continued ridge of rugged mountains. This province includes a superficial extent of 17,000 miles, of which one-fifth part is under culture, two-fifths in

Circassia. pasture, and the remainder is covered with woods, water, and barren hills. This territory is distributed into five natural divisions, which are marked by the rivers which, deriving their origin from the mountains on the western frontier, traverse the whole region.

CIRCASSIA, a province of Asiatic Russia, forming a considerable part of the region called *Caucasia*, and lying between 40° and 50° of east longitude, and 45° and 50° of north latitude. It is bounded on the north by the river Don, on the east by that part of the Caspian sea which receives the waters of the Volga, on the south by the elevated regions of mount Caucasus, and on the west by the Black sea and the sea of Asoph.

General aspect.—The general surface of this district is pleasantly diversified with hill and dale, plain and mountain. The plains are watered by several rivers, and the country is for the most part well provided with wood. The soil is naturally rich and fertile, and the climate one of the most delightful in southern Russia; warm and salubrious in the lower grounds, but keen and penetrating in the more elevated parts.

Mountains, Rivers, &c.—The mountains of Circassia constitute the northern part of the great Caucasian ridge that extends between the Euxine and the Caspian, and consist chiefly of four elevated groupes, which are generally capt with snow; one of which is very conspicuous, rivalling in height the most eminent of the European alps. A less elevated, but more precipitous ridge, next the plain, is called the *Black Mountains.* Besides the Don and the Volga, there are several rivers proper to this district, especially the *Kuma* which runs into the Caspian, and the *Kuban* which flows into the Black sea. In the course of the former there are several small lakes; and some canals occur, though adapted rather to the conveyance of water than the purposes of navigation.

Natural history.—Circassia affords no uninteresting field to the naturalist. Its mountains contain limestone, sandstone, sulphur, pyrites, ironstone, and vitriol; and in the plains are found petroleum, common salt, natron, magnesian salts, and alum, and in some places warm sulphureous springs. Numerous vegetables which are cultivated with difficulty in our northern climates are indigenous; as the laurel, the olive-tree, the fig-tree, the lotus, the pomegranate, the strawberry-tree, the caper-bush, and the wild vine. About the mountainous regions are found several birds of prey, and game is in abundance. Deer inhabit the plains, and in the forests is occasionally seen the tiger.

Population.—We have no means of ascertaining the absolute population of this district. M. Pallas, in estimating its military force, reckons it at near 12,000 men, all cavalry, of whom about 1,500 belong to the rank of Hyden or nobles, and about 10,000 are vassals; but probably this number is far below even the military part of the inhabitants.

Divisions.—The Circassians are divided into several distinct and separate tribes, as the Kabardines, the Beslene, the Temirgoi, the Pshedukhs, the Hattuckai, the Sheni, the Shagaki, and the Mukhosians. There is scarcely a place in the whole province which deserves the name of a town, except *Terke*, which is situated in a swampy plain towards the Caspian sea, on the river Terek, and is surrounded with modern fortifications, about three versts in compass. It is the residence of one of their chief princes, and of a Russian garrison. The other places are chiefly villages, the houses of which are constructed only for temporary convenience, and are frequently shifted from one place to another. The houses intended for the residence of females are distinct from those of the men. In estimating the number of families in a village, the number of kettles employed is reckoned.

Agriculture.—In this province agriculture is but little attended to, especially that part of it which respects the tillage of the ground. The principal grains cultivated are barley, millet, and maize; and the only artificial manure employed consists of turf, burnt upon the surface of the ground. Successions of crops are not regarded; and the same piece of ground after having been cropped for three years is abandoned for another. The Circassians pay most attention to the rearing of sheep and cattle, and more especially of horses. They generally plough with oxen, and sometimes employ camels for draught; but their horses are kept entirely for the saddle, and they pride themselves much on the beauty and pedigree of these animals. Every chieftain breeds a race of horses peculiar to himself, and considers their genealogy as little less important than that of his own family. Their pedigree is marked by a stamp burnt on the thigh of the foal; and to forge this stamp is considered a capital offence. The cultivation of bees is also an object of importance in this province, and some individuals are said to possess 200 or 300 hives. The wax and honey produced are excellent.

Manufactures and commerce.—Very few manufactures, and these chiefly of a domestic kind, are carried on. They consist principally of steel heads for arrows, hempen thread, narrow woollen cloth, which is worn of the natural colour, a light kind of felt for clothes, leather for housings, and gold and silver lace for embroidery. The commerce is also trifling, and is carried on almost entirely by way of barter—money being in this country little known. The chief exports are slaves, which are either prisoners taken in war, or the vassals of the nobility; honey, wax, skins of deers and tygers, and especially horses. The last are in great request among the neighbouring provinces, and fetch a very high price. The most beautiful females among the Circassians still form an object of traffic, being destined to inhabit the Turkish seraglios. These ladies are generally sold through the medium of Armenian merchants, and sometimes produce to their parents 4000 Turkish piastres, or about L.800 of our money. This traffic, which appears so strange to us, is considered no disgrace among the Circassians; and it is said that the females thus disposed of, are much happier than if they had married any of their native princes.

Inhabitants.—The Circassians form one of the seven Caucasian nations. They are divided into three or four classes, viz. princes, hydens or nobles, freed-men, and vassals. The princes possess the sovereign authority in their several districts, and have long been regarded as petty tyrants, much resembling what our Highland chieftains were in the early part of the 18th century. The nobles are nearly independent of the prince, except when attending him in his warlike or predatory excursions. They are remarkable for their pride, ostentation, and indolence, passing their time in hunting and feasting while at home, and, when abroad, in plundering their neighbours. They never go out without being completely clad in armour. Their arms, which often cost from L.200 to L.400, consist of a bow, a quiver fastened round the waist, and hanging down upon the thigh, a musket and pistols richly ornamented, a helmet and arm-plates of polished steel, and over these a coat of mail formed of polished steel rings of such a temper as to resist a leaden bullet. The freedmen hold a middle rank between the nobles and vassals, being dependent on the former only as military followers. The vassals are in every respect the slaves of the nobility, and are employed in agriculture and as domestic servants. They are often sold by their masters, and are sometimes punished by them with death without the form of trial.

The dress of the Circassians consists of a vest and great coat, which in the higher ranks are richly embroidered, and of a cap, usually of red, but different according to the sex or age. In their persons they are generally tall and handsome, with fair complexions, fine eyes, small waists and feet. Much of their food consists of horse flesh, millet, maize, and mare's milk, from which last they prepare a fermented liquor. In their general character, they are haughty, revengeful, and so universally dishonest that, as among the ancient Spartans, theft is considered as no crime, unless it be detected. They are much addicted to smoking, and their chief amusements are music and dancing. The children of the nobility are said to be educated at a distance from home; they are trained to war and plunder, and their instructors are rewarded with the greatest share of the spoil taken in their first excursions.

Government, Religion, Laws, &c.—Their government appears to be a feudal aristocracy. In point of religion they are either Pagans, Mahometans, or Christians, according to interest or the will of their more powerful neighbours. They offer sacrifices to the Deity, but so little regard do they pay to the Divine Being that perjury is as common among them as theft. The nobility use a peculiar language, and in writing they employ the Arabic character.

CIRCLE, a plain figure, comprehended by a single curved line, called the circumference, to which right lines drawn from a point in the middle, called the centre, are equal to each other. Circle is a term in geography, as, *circles of the sphere*, and *circles of longitude and latitude*.

CIRCUIT is a term applied to the journey or progress which the judges make twice every year through the counties of England and Wales, for the administration of justice. England is divided into six circuits, the Home, Norfolk, Midland, Oxford, Western, and Northern circuits: Wales is divided into two, North and South Wales; and, by the king's commission, two judges are appointed to each circuit.

Scotland is divided into three circuits; the Northern, the Southern, and the Western, and to each circuit two judges of the Supreme Criminal Court, or Court of Justiciary, are assigned.

CIRCULATION, literally signifies moving round, or in a circle, as when it is applied to the circulation of the blood, or its motion in a living animal, by which it is conveyed by the arteries from the heart to all parts of the body, and returned to the same organ by the veins. See ANATOMY.

CIRCUMFERENTOR, a mathematical instrument, which was formerly employed in land-surveying, and which is applied to the measurement of angles by means of the magnetic needle; but it is now superseded by more perfect instruments.

CIRCUS, an edifice among the ancient Romans, in which were exhibited games and spectacles for the amusement of the people. Some of these edifices were of great extent, and, it is said, were capable of admitting 250,000 spectators. In some of them too, water was admitted for representing sea-fights. Of these edifices the most magnificent were constructed by Augustus and Nero; and remains of such buildings are still visible at Rome, Nismes in France, and other places. The games exhibited in them were called *Circensian games*; and as they were celebrated in honour of Consus, the god of counsels, they had sometimes the appellation of *consualia*; and as they were first instituted, or much sought after by the Roman people, they were called Roman games.

CIRENCESTER, a market-town of Gloucestershire, in England, stands on the river Churn near the borders of Wiltshire, was a place of great strength when in possession of the Romans, and contains about 5000 inhabitants, who are occupied in the manufacture of fine woollen cloth, carpets, and some cutlery.

CISSAMPELOS, a genus of plants belonging to the Polyadelphia class.

CISSUS, the WILD-GRAPE, a genus of plants belonging to the Tetrandria class.

CISTUS, the ROCK-ROSE, a genus of plants belonging to the Polyandria class. See BOTANY.

CITHAREXYLON, FIDDLEWOOD, a genus of plants belonging to the Dydinamia class.

CITRUS, the CITRON-TREE, a genus of plants belonging to the Polyadelphia class; and beside the citron, including under it the lemon, the orange, the lime, the shaddock, and the forbidden-fruit of the West Indies.

CITY, according to the definition of English lawyers, is a corporate town, which is the see of a bishop, or has been at some former period the see of a bishop, of which Westminster, which retains the appellation of city, is alluded to as an example; although it is alleged by some, that the distinction between cities and towns was introduced into England subsequent to the conquest. For an account of the progress, privileges, and immunities of cities, the reader may consult *Robertson's History of Charles V.*

CIVIDAD-DE-LAS-PALMAS, the chief town of the island of Canary; contains excellent houses;

is a bishop's see, with a handsome cathedral; and the inhabitants, with the advantage of a good harbour, enjoy a temperate air.

CIVIDAD-RODERIGO, a town of the kingdom of Leon in Spain, stands on the river Agueda; is well fortified; contains numerous public-buildings, and about 10,000 inhabitants, who were formerly engaged in the manufacture of tapestries, embroidery, laces, and leather; some of which, from this part of Spain having been lately the seat of war, have declined.

CIVIL LAW, is properly the law of any state or country, but is usually employed to denote a body of laws derived from the Institutions of the Romans, or compiled from their laws. See LAW.

CIVITA-VECCHIA, a sea-port town in the territory of the church in Italy; has a good harbour and arsenal, and is the station for the pope's galleys. The population is stated at 9000. Manufactures of pottery-ware, leather, and linen, and cotton-cloths, have been established; and sulphur, alum, grain, oils, wool, and timber, are enumerated among the exports; while French wines, fruits, salted fish, and woollen and linen cloths, are imported.

CLACKMANNANSHIRE, the smallest county in Scotland, lying on the north bank of the river Forth, between 3° 33″, and 3° 36′, W. Long. and 56° 8′, and 56° 44′, N. Lat. It is bounded on the south and south-west by the Forth; on the south-east by Fifeshire, and on the north north-east and north-west by Perthshire. Its superficial extent is about 52 square miles.

General aspect.—In its general aspect, Clackmannanshire presents a pleasing variety of hill and dale. The northern part is rocky and mountainous, its southern coast low and level, and an intermediate elevated tract extends from west to east. This district is well watered, and covered with numerous plantations. The soil is partly of a gravelly nature, resting on sand or clay, and partly of rich alluvial land, skirting the Forth. The former is called dry-field and the latter carse-land. The climate is so salubrious, as to have obtained for this district the title of the Montpellier of Scotland.

Mountains and Rivers.—On the north of Clackmannanshire lie the Ochill hills, some of which are of considerable elevation. Thus, Ben-cleugh rises 2500 feet, and Dunmyatt 1345 feet above the level of the sea. Besides the Forth, which runs in a very tortuous course round a great part of the county, there are two smaller rivers, called the Devon and Black-Devon; the former flowing from Perthshire, the latter from Fife. The Forth is remarkable for its double tides.

Natural history.—Many valuable minerals are found in this county, though some of them occur in small quantities. In the Ochills are found green-stone, flint-rock, basalt, amygdaloid, limestone, agates, or Scotch pebbles, and coarse breccia, and numerous metals have been detected, though not in sufficient quantity to repay the labour and expence of working them. Among them may be enumerated silver, copper, lead, cobalt, and arsenic, all of which were formerly wrought, but these mines are now abandoned. There is still obtained a large quantity of iron, but the chief mineral treasure of the county is coal. This is of the hard, cubical, or slaty kind, and is among the best in Scotland. It is found in great abundance in almost every part of the county; and such is the demand for this production that above 130,000 tons are annually brought to market. It is worthy of remark that this county forms part of the northern boundary of the great coal field of Scotland, no coal having yet been found north of the Ochills, if we except the county of Sutherland. Freestone is also wrought, but its quality is by no means good. Excellent millstones have been made of the greenstone.

The plants and animals of this county are much the same with those of the adjacent districts. Many goats browse upon the hills, and salmon are taken in the Forth. All kinds of timber suitable to the Scottish climate thrive well.

Population.—The population of Clackmannanshire, according to the return in 1811, is estimated at about 12,000.

Antiquities.—There are here no remains of antiquity, except a few buildings that appear to have been erected about 500 years ago. These are the tower of Clackmannan, the tower of ALLOA, already noticed under that head, and the abbey-tower of Cambus-kenneth, within which were interred the remains of the Scottish monarch, James III.; there is also an old castle in the parish of Dollar, which formerly belonged to the Argyll family, and called from them Castle-Campbell, though, by a whimsical play on the name of the parish, it is more generally distinguished by the title of Castle-gloom, while two rivulets that run near it are denominated the burns of Care and Sorrow.

Divisions.—This county is divided into five parishes, viz. Clackmannan, Alloa, Tillicoultry, Dollar, and Logie. The principal towns are Clackmannan, the county town, and Alloa, the latter of which has been already described. See ALLOA.

Clackmannan is a small town, containing about 700 inhabitants, is situated on a rising ground, is irregularly built, and consists chiefly of small houses, many of which are in a state of decay, and the town-house and prison are both nearly in ruins. The tower, which stands on the brow of the hill, at the west end of the town, is of a rectangular figure, is about 80 feet high, and was formerly the residence of the chief of the Bruces. The view from its summit is extremely fine, commanding one of the most beautiful landscapes in Scotland. North Lat. 56° 15′, W. Long. 3° 40′. This town is 22 miles above Leith.

Agriculture.—The husbandry of this county has long been in a very improved state, and the corn lands were, even 100 years ago, well cultivated, and highly productive. The farms are in general small, none of them exceeding 200 Scotch acres, and most being below 100. The total rental of the county is estimated at L32.000; and as it comprehends about 36,000 acres, the average rent of what is employed in agriculture is at least twenty shillings per acre. This district is very deficient in lime, but this defect is supplied partly from East Lothian, and partly from the neighbouring lime-works of Lord

Elgin. There has lately been a considerable tract of land next the Forth secured by embankment. It is remarkable that the first thrashing-machine constructed in Scotland was erected here in 1787.

Manufactures and commerce.—The principal manufactures are those of whisky, ale, and pig-iron. There are in this county six large distilleries, of which that at Kilbagie consumes annually about 60,000 bolls of grain, and feeds during the same time about 7000 cattle, and 2000 swine. The ales brewed at Alloa are reckoned among the best in Scotland. The chief production of pig-iron is at the Devon iron-works, where 60 tons are made weekly. For the other manufactures of this county, see ALLOA. The principal exports are tools, iron, and whisky, of which last article at least a million of gallons are exported annually. The imports are chiefly grain and sugar from the coast, and timber and wrought iron from the Baltic. The internal trade is promoted by excellent roads and railways.

This county sends, alternately with Kinross-shire, one member to Parliament.

CLAIRAUT, ALEXIS CLAUDE, an eminent French mathematician, was the son of a teacher of mathematics, and was the second child of a family of twenty-one children, several of whom it would appear were strongly attached to geometrical investigations. He was born at Paris in 1713, was taught the alphabet, it is said, on the figures of Euclid's Elements, a circumstance which may have given the bias to his future studies, and when he was not more than four years of age he could both read and write. He discovered an early attachment to the military profession, and was thus encouraged to acquire mathematical knowledge as an essential qualification.

By the time he had reached his tenth year, young Clairaut was familiar with conic sections, and the application of algebra to geometry; and such was his ardour in those studies for which he became afterwards so distinguished, that he and a younger brother, unknown to his family, and contrary, it would appear, to the express command of the father, spent those hours which are usually devoted to repose in tracing the properties of curves, and had actually composed a memoir on the subject. The members of the academy of Sciences, before whom the memoir was read, expressed doubts of his being the real author of the discoveries which it contained, and they were only satisfied by conversing with the young mathematician.

Clairaut was only eighteen when he was admitted, by a special dispensation, into the academy; he accompanied Maupertuis to Lapland, for the purpose of measuring a degree of the meridian; and on his return he received a pension from the king. In succeeding years his income was augmented by similar grants, and he was thus enabled to devote his labours to his favourite studies. Beside the memoirs which he presented to learned academies, Clairaut was the author of numerous works on the profounder branches of mathematical knowledge, and on various departments of natural philosophy, particularly of optics. He died in 1765, when he was only in the 52d year of his age.

CLARE, a county in the province of Munster, in Ireland, is bounded on the west by the Atlantic ocean, on the north by the county of Galway, and on the east and south by the river Shannon, which separates it from the counties of Tipperary, Limerick, and Kerry; its extreme length, from Deingheart-lough, an expansion of the Shannon, to Loop-head promontory on the Atlantic, is upwards of sixty miles, and its mean breadth from north to south is about 30, the whole extent of the area being 1159 square miles. Owing to the natural sinuosities of its water boundary, by which it is surrounded on three of its sides, this surface exhibits a very irregular outline. Towards the eastern frontier is a chain of hills, composed chiefly of limestone, which is so widely diffused throughout this part of the country as in many places to give the surface the appearance of naked rocks, and to render the sea shore bold and precipitous. In the limestone beds are found calcareous-spar, manganese, and lead and iron ores. The Shannon, in its course from *Lough-Allen*, in the county of Leitrim, flows with majestic strength along two sides of its frontier, varying in width from one to ten miles; a number of streams also traverse the interior, the principal of which is the Fergus, forming, on its confluence with the Shannon, a noble estuary, studded with green isles. Although Clare has a large extent of coast, it has little good anchorage, either in the mouth of the Shannon or on the shore of the Atlantic; the bays are few in number, and the ground is impeded with huge blocks of stone, which are perpetually shifting their position by the violent action of the wind and the waves.

The face of this county exhibits a very naked appearance; not more than about 800 acres of the whole county are covered with wood; and lakes and bogs, and barren hills, expand over a large extent of the surface. There is, however, a great deal of rich pasture, and tolerably fertile lands in the county. Sheep and cattle are reared in great numbers in the high and rocky parts of the county; a tract of about 20,000 acres, on the banks of Fergus and Shannon, of a rich loamy or clayey soil, is kept in pasture for fattening bullocks, for which it is said to be well adapted. The produce of the dairy is also a considerable source of emolument, though the mode in which it is managed is neither cleanly nor economical. The land under tillage is sown chiefly with oats, great quantities of which are exported to Scotland. Much of the ground, especially in the upper districts, is cultivated with the spade, and sown with rape-seed, the produce of which is sent to Yorkshire, to have the oil expressed for the use of the woollen manufacture. Beans are not cultivated so extensively as formerly; a good deal of flax, chiefly for home consumption, is raised throughout the county; and the potato, the staple of Ireland, is not neglected in Clare. This part of Ireland has long been famous for its cyder; and that which is known by the name of the Cackagee-cyder, has been peculiarly celebrated for its exquisite flavour. Various accounts have been given of the preparations of this species of cyder; some asserting that is made from the side of the apple only which enjoyed the greatest quantity of sun-shine; some, that it is prepared from the juice of the first squeezing; some, again, maintain, that its flavour is owing to the apples from which it is made being permitted to undergo a partial fermentation in the heap; and others are of opinion that it is the produce of a peculiar species of apple, which grows chiefly in the vicinity of the sea, and yields a precarious crop, which accounts for the scarcity of the produce. The cyder-orchards of Clare are said at present to be on the decline.

Divisions, Towns, &c.—This county is divided into nine baronies and seventy-nine parishes, the most of which belong to the see of Killaloe. The benefices of the county are only thirty, and the churches not so many; there being, in numerous instances, two or more parishes united into one. The landed interest adhere, for the most part, to the established church; but the tenantry, many of whom are men of property, are, with few exceptions, Roman catholics. The towns of note are, Clare, Ennis, and Dromore, all situated on the river Fergus. The population is supposed to amount to about 104,000 souls. The county sends two, and the burgh of Ennis one member to represent them in the British House of Commons. Clare was once a principality of the O'Briens, and was then called Thomond, which afterwards gave rise to the title of the Earl of Thomond now marquis, which is still held by a family of the name of O'Brien. It received its present designation from that of Thomas de Clare, earl of Gloucester, on whom a large portion of its territory was conferred on his settling in Ireland in the year 1276.

CLARKE, Dr SAMUEL, an eminent divine, was born on the 11th October 1673, in the city of Norwich, of which his father was an alderman and a representative in Parliament. He commenced his education in the free-school of his native city, then taught by Mr Burton; and soon distinguished himself by his aptitude for classical learning. In the 17th year of his age he was entered a student of Caius college, Cambridge, under the tuition of Mr, afterwards Sir John Ellis, where the excellence of his exercises quickly raised him to a high degree of eminence, and procured him the appellation of "*the Lad of Caius.*"

The fanciful philosophy of Des Cartes was still at that time taught in the university as the true explanation of the phenomena of nature; but Clarke, in quest of a system founded on more solid principles, betook himself with ardent application to the study of Newton's Principia, lately published, and known only to the few. From that work, with the main points of which he had made himself familiar, he chose the subject of the thesis to be performed by him in the schools, for the attainment of his first degree; in which he displayed an accuracy of knowledge, and a clearness of expression, that excited the admiration of the whole audience, and left on their minds a deep impression of the strength of his talents.

M. Rohault's Outlines of Philosophy, written in barbarous Latin, and founded on Cartesian principles, was then the text-book of the philosophical lectures in the university. Of this work, Mr Clarke, before he had attained the 21st year of his age, published a new translation, in classical Latinity, accompanied with copious notes, illustrative of the Newtonian system; and by this means he succeeded in withdrawing the attention of the students from the arbitrary hypothesis which had hitherto passed for philosophy, to the attainment of substantial knowledge, through the medium of demonstration and deduction. His translation and notes were adopted as the class-book of the university; they passed through four editions, and were only set aside by the publications of Rutherforth and Rowning, on the complete ascendancy of the Newtonian system,—an event to which they essentially contributed.

Having commenced the study of theology, he read the Old and New Testaments in the original with great accuracy and care, in the course of which he made many critical remarks; and, immediately on his taking orders, he was appointed chaplain to Dr Moore, bishop of Norwich, who had long regarded him as a young man of uncommon talents and great promise. He lived in this capacity nearly twelve years, enjoying the warm friendship and the entire confidence of his patron, who, on his death, entrusted to his care the management of his family affairs.

In 1699, the 26th year of his age, he published two treatises; the one of which was intitled, Three Practical Essays on Baptism, Conformation, and Repentance; and the other, which he published anonymously, was intitled, Some Reflections on Amyntor,—a book relating to the primitive Christians and to the canon of the New Testament. And though these treatises are not worthy to be compared with the theological works afterwards published by him, yet they display uncommon acquaintance with the manners and customs of antiquity, and are creditable specimens of his progress in theological learning. Availing himself of the leisure he enjoyed in the family of the bishop of Norwich, as well as of the excellent library to which he had there free access, he proceeded with unremitting perseverance in the study of the Scriptures; and turned his studies to so good an account, that he published a paraphrase, with critical notes, first of Matthew and soon after of the other three Evangelists; the design of which, as he himself assures us, was "to express the full sense of the Evangelists in the plainest words, and to continue the sense, without interruption, by the clearest translations he could." His other avocations prevented him from proceeding in the same manner with the other books of the New Testament, which he himself used to say was not to be regretted, as the labours of others had rendered it unnecessary,—a sentiment in which the biblical student can by no means agree.

After these proofs of Mr Clarke's talents, and of his perseverance in their improvement, he was presented by Bishop Moore to the rectory of Drayton, who also procured for him a living in the city of Norwich; both of which he constantly served during his patron's residence at the seat of his diocese, till by the same patronage he was removed to London. In 1704, he was appointed to preach the lecture founded by Mr Boyle; and in the discharge of this duty, for which he was so eminently qualified, he chose, as the subject of his discourses, the being and attributes of God, which he endeavoured to

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prove by the argument *a priori*. In this great attempt he was regarded as having succeeded so well, that he was re-appointed to the same lecture the ensuing season; when he followed up his former design in a series of sermons on the evidences of natural and revealed religion. These discourses, which at first were published separately, have long been associated in the same volume, and are too well known to require any description or criticism in this place. In regard to the first of these treatises, it may be grateful for some readers to know, that the argument *a priori* is supposed to have been suggested to him by a passage in Newton's Principia. Proceeding on the principles which he thence derived, he argues, that "space and time are only abstract conceptions of an immensity and eternity which force themselves on our belief; and as immensity and eternity are not substances, they must be attributes of a Being who is necessarily immense and eternal." The argument *a posteriori*, however, which conducts the mind to the inference of *an intelligent cause* from the marks of *design* apparent in the universe, is more within the grasp of ordinary capacities; but it has been the hard duty imposed upon the defenders of religion and morality to follow atheists and infidels in all their devious and wayward wanderings, in order to guard the unwary from being misled by their errors. As, therefore, Spinoza and Hobbes had employed all the subtilities of metaphysics in support of fate and necessity, Mr Clarke, who had resolved to enter the lists with them, chose to meet them on their own ground, and to fight them with their own weapons. "Every Christian," says Bishop Hoadley, "should esteem these discourses as *his treasure*, as they contain the true strength, not only of natural but of revealed religion, which, if ever it be removed from such a foundation, and separated from such an alliance with reason and uncorrupted nature, will not long subsist in the belief of persons of understanding after such a separation, *and therefore what God has joined together let no man put asunder*."

After these proofs of splendid talents, directed to such important purposes, it was not difficult for his patron, Bishop Moore, to promote his preferment in the church to stations more conspicuous than he had hitherto occupied; and therefore, in the year 1706, he obtained, through his interest, the rectory of St Bennet, Paul's Wharf, London, where his preaching was acceptable and instructive. Mr Dodwell had, about this time, in order to exalt the priesthood, maintained, in his Epistolary Discourses, that the immortality of the soul is the gift of God conferred at baptism, through the medium of such clergy only as were ordained by a bishop. This singular position having attracted much attention, Mr Clarke was solicited to write a confutation of it, which he did in a manner that gave general satisfaction. Mr Clarke's letter to Dodwell gave rise to Mr Collin's *Inquiry into Human Liberty*; by which a controversy was provoked in which a variety of combatants appeared on both sides; and though Mr Clarke was at the head of one of the parties, and had besides the fulfilment of all his official duties in his hands, he found time during the same year to publish an elegant Latin translation of Sir Isaac Newton's Optics,—a task to which he had been solicited by the author.

The bishop of Norwich now introduced him at court, and recommended him to Queen Anne, who made him one of her chaplains in ordinary, and presented him soon after to the rectory of St James's, Westminster; on the duties of which elevated station he entered in the year 1709. From the time of his taking possession of this living, he resided constantly in the rector's house, and regularly performed all the duties of the cure. On his advancement to this station, which led him to associate with men of rank, as well as with men of learning, he judged it proper to take the degree of doctor of divinity, to which, from his standing in the university, he was entitled. For this purpose he went to Cambridge, and proposed, as the subject of his public exercise, the two following questions.

1. No article of the Christian faith, delivered in the Holy Scriptures, is repugnant to right reason.

2. Without the liberty of human actions there can be no religion.

These questions he maintained in a long disputation, with great fluency of speech, and ingenuity as well as strength of reasoning. Dr James, the regius professor of divinity, who was his antagonist on this occasion, put an end to the dispute in a manner highly honourable to his respondent. Instead of saying, according to his custom with other candidates, *I will now make an end, for I have sufficiently exercised you*,—he said, *I will now make an end for you have sufficiently exercised me*, which was regarded by the learned and admiring audience as a great and well earned compliment.

A few years after this event, he published his scripture doctrine of the Trinity, which involved him in a tedious controversy with Dr Waterland and others. The same treatise was also complained of by the lower house of Convocation; but the bishops having declared themselves satisfied with his explanations, the complaint was dropt. But he adhered firmly to the opinions which he had avowed in the scripture doctrine, and even excited the controversy anew by the alterations he made in the doxologies subjoined to the Psalms. Amid these discussions, he entered the lists with Leibnitz, on the question of man's free agency. This was a subject which he had deeply considered, and as he was aware of his antagonist's subtilty, he put forth all his strength, and is thought to have excelled himself. He inscribed his papers on this question to the Princess of Wales, afterwards Queen Caroline, who was pleased to take an interest in the issue of the dispute. In the year 1725, he published seventeen sermons on various subjects, which was the last of his theological works published by himself. He was made master of Wigstan hospital by Mr Lechmere, chancellor of Lancaster,—a gift which was enhanced in value by the handsome manner in which it was bestowed; and on the death of Sir Isaac Newton, he was offered the mastership of the *Mint*,—a secular office, which he declined, out of respect to the dignity of the clerical character.

Theological studies, however, did not employ the whole of his time; philosophy, mathematics, and natural philosophy also enjoyed a share of his attention. In 1712, he published a splendid edition of Cæsar's Commentaries, in folio, enriched with notes, and embellished with engravings,—a work which is still unrivalled either in beauty or correctness.

He published also, in the year 1729, the first twelve books of Homer's Iliad, with an elegant Latin translation, and a great variety of valuable notes. The last twelve books of the same poem were published in 1732, by his son, who assures the public, that the first three of them, with part of the fourth, were printed from his father's manuscripts. He confessed himself much indebted to the works of Sir Isaac Newton, with whom he lived in habits of intimate friendship; and when this intimacy was dissolved, by the death of Sir Isaac, Dr Clarke gave the world a proof of his affection, in an able vindication of his theory on the velocity and force of bodies in motion, addressed in a letter to Mr Benjamin Hoadley, and which is printed in the transactions of the Royal Society for 1728.

Dr Clarke had married Catherine, the only daughter of the Reverend Mr Lockwood, rector of Little Massingham, by whom he had seven children; and in whose society he was happy till his death. But his domestic felicity, and the labours of a useful life, were soon to come to an untimely termination. His health had seldom been interrupted during the whole course of his career; and his constitution was apparently sound; yet, on the Sunday morning, 11th May 1729, after he had left his house to preach before the judges at Serjeant's Inn, he was seized with a violent pain in his side, and was carried home in a state of agony. After copious bleeding, he was so much better as to be thought out of danger; but in the course of a few days the pain returned, and having fixed itself in his head, it first deprived him of sensibility, and on the evening of the 17th of May, 1729, put a period to his mortal existence, in the 56th year of his age.

Ten volumes of sermons, and an exposition of the church catechism were, soon after his death, published under the inspection of his brother. The latter of these works contained the substance of a course of lectures which he had delivered on the Thursday mornings, in the church of St James, and which is said to have been left by him in a state of readiness for the press.

Such were the life and the labours of Dr Clarke,—a man of profound talents, extensive attainments, and of great and venerable virtues. The purify of his own Latinity, and the number and excellence of his critical and philological notes on Cæsar and Homer, are the best proofs of his classical learning; his early attachment to the Newtonian philosophy, and his publications on the subject, show his skill in the abstract sciences, and in those branches of knowledge which rest on fact and experiment; his demonstration of the *being* and *attributes* of God, and most of his controversial tracts, display a metaphysical depth and perspicuity which has not yet been excelled; and to crown the whole, all his theological works display tokens of profound thought, accurate discrimination, and biblical knowledge, far beyond the reach of ordinary minds. To this richly endowed and highly cultivated mind, were united great meekness and modesty of temper, which rendered his behaviour gentle and obliging, free from vanity and overbearing dogmatism in an eminent degree, and which made his society delightful and instructive. As a preacher, his manner is said to have been plain and impressive,—aiming at enlightening the understanding rather than touching the feelings. Till he was stationed in London, he delivered his discourses without notes; but after he came to the parish of St James', he composed his sermons with great care; and from the clearness with which he illustrates the doctrines, and the earnestness with which he recommends the precepts of the gospel, (of which every one may judge for himself by a perusal of his sermons,) it is no more than justice to declare, that he was a bright ornament of the church, and a masterly teacher of truth and virtue.

CLAVARIA, CLUB-TOP, a genus of plants belonging to the Cryptogamia class.

CLAUDIAN, or CLAUDIANUS CLAUDIUS, a Latin poet who flourished in the fourth century, and is said by some to have been a native of Spain, or of Italy, while others suppose that he was born in Alexandria in Egypt. Claudian lived during the reigns of the emperor Theodosius, and of his sons Arcadius and Honorius; he was in great favour with the celebrated general Stilicho, and through his influence rose to places of importance and dignity in the state; but after the disgrace and tragical end of his patron, he seems to have retired from public affairs, for no record is preserved of the remaining part of his life.

The works of Claudian consist of satires, idyls, and epigrams, the rape of Proserpine, and part of an epic poem which it is supposed was never finished. When it is said that Claudian approaches to Virgil in the harmony and dignity of his versification, and that his writings are distinguished by the elegance and classical purity of the Augustan age, no mean opinion can be formed of his talents as a poet, although it must be added that his compositions are also remarkable for great inequalities.

CLAYTONIA, a genus of plants belonging to the Pentandria class.

CLEF, or CLIFF, a character in music, expressed also by the term *key*, and employed to mark the position of different musical parts in the general system, and the relations which they bear to each other. See MUSIC.

CLEMATIS, VIRGIN'S BOWER, a genus of plants belonging to the Polyandria class.

CLEOME, a genus of plants belonging to the Tetradynamia class.

CLEPSYDRA, an instrument or machine, which, as the name derived from the Greek imports, was employed for the measurement of time, by the fall of a certain portion of water. Such instruments were in use among the ancients; they are said to have been of Egyptian invention; and they were employed by astronomers for measuring the time in which the heavenly bodies performed their motions, but are now altogether superseded by more perfect instruments.

CLERMONT, capital of the department of Puy-de-Dome in France, stands on an eminence near the foot of a mountain, has narrow streets, but enjoys the advantage of fine walks and splendid public places; linen, woollen, and silk-stuffs, candles, and paper, are enumerated among its manufactures; the preserved apricots, and the cheese of the neighbourhood, are much celebrated, and a remarkable petrefying spring rises within the city. The population is stated at 30,000.

CLETHRA, a genus of plants belonging to the Decandria class.

CLEVES, the capital of a duchy of the same name, in the circle of Westphalia, is an ancient town, contains a population which exceeds 40,000; has a manufacture of silk-stuffs, linen, and tobacco. The duchy of Cleves is about 40 miles in length and 20 in breadth; is traversed by the Rhine; and fell under the dominion of the French during their revolutionary progress.

CLIFFORTIA, a genus of plants belonging to the Decandria class.

CLIMATE is a geographical term, denoting part of the surface of the earth, bounded by two circles, parallel to the equator, and of such a breadth as that the longest day in the parallel nearest the pole exceeds the longest day in that next the equator by a a certain time, as, for example, half-an-hour. See Geography and Meteorology.

CLINOPODIUM, Field-basil, a genus of plants belonging to the Didynamia class, and of which one species is a native of Britain.

CLOCK, a machine constructed with wheels, and regulated by the motion of a pendulum, for the measurement of time. See Horology.

CLONMEL, a market-town of the county of Tipperary in Ireland, stands on the banks of the river Suire, which is navigable to the town, and has a considerable trade in pickled bacon, besides some manufactures of woollen and cotton stuffs.

CLOTH MANUFACTURE.

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This term, in its most common acceptation, signifies the fabrication of yarn, or other filaments, into cloth; and constitutes, strictly speaking, the business of a master weaver. In the present improved state of our cloth manufacture, however, when the preparatory as well as the finishing processes are frequently concentrated in one establishment, the term is used in a more extended sense, and usually embraces, not only the whole art of weaving, but every other art or process which is necessary to reduce the raw material into cloth, and afterwards to finish the goods for the market. But as several of the arts connected with the manufacture, such as spinning, dyeing, bleaching, &c. are of sufficient importance to merit a separate place in this work, it has been deemed proper to omit them in this general treatise, and refer the reader to those heads under which they are respectively discussed.

The early part of the history of weaving is very little known, and even what is on record affords no satisfactory information relative to the processes by which the ancients conducted their cloth manufactures. The most simple and obvious method of forming a fabric by the intertexture of warp and woof, that probably would present itself in the first attempts at ornamental weaving, is, to separate the warp threads at certain intervals by the hand; and, after passing a break or shuttle, containing the woof, through these partial sheds, to regulate the fabric by the application of a pointed instrument adapted to this purpose. The processes of weaving in India and other eastern countries, where mechanical means do not appear to be much resorted to, cannot be well accounted for on any other principle; neither can some of their most beautiful patterns be successfully imitated by any apparatus with which we are acquainted. Indeed, from the very imperfect accounts which have reached us respecting the processes of India, they appear to border very closely on the simplicity of this method. The Indians prepare their cotton for spinning, by separating it with the string of a bow, which is kept vibrating by the hand until its fibres are opened into a fine down or fleece. Their method of spinning, even the very finest of their yarn, is still by the distaff and spindle. In weaving muslins of the most delicate fabric and texture, their apparatus is equally simple. The warp is stretched between two rollers, under the shade of some convenient tree, and over a pit that has been dug for the purpose. What constitutes their heddles is suspended from a bough; and two loops, into which the two great toes are introduced, are formed on cords below, and serve instead of treadles or other mounting. The woof is inserted by a kind of long shuttle, which also performs the office of our reed and lay, by which we shut up the woof. In weaving their more fanciful and complicated patterns, the warp is also wound upon a roll, which is frequently suspended between two trees; and, being equally stretched in a vertical position by another roll below for receiving the cloth, the woof is inserted by a long needle, which is dextrously employed by the operator in secluding such of the warp-threads as are raised by our mountings. This process has some resemblance to our method of reading an extensive flower on the simple of a harness. When the threads of woof are thus interwoven with the warp, which are often linked into each other in a very curious manner, they are drawn close to the face of the cloth by another instrument similar to a comb.

From these instances it may naturally be inferred, that, as the mechanical arts in India and other parts of Asia are confined to particular families, and have been handed down from time immemorial, probably without any alteration, the processes of weaving and apparatus of the ancients were likewise extremely simple, and that manual dexterity constituted the leading principle of their art, and supplied the plan of our most complicated machinery. Hence, also, it would appear, that whatever progress the European weavers may have made in imitating these oriental manufactures, they are little indebted to this quarter for any practical knowledge of their fabrication.

The art of weaving was unknown in Britain before

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the Roman invasion. On the landing of Julius Cæsar, he found the natives almost without clothing, and the little that they wore consisted of the skins of animals, great part of their bodies being naked, and painted with various colours. The Romans established a woollen manufactory at Winchester for clothing their army, and also taught the natives the art of weaving. The party-coloured stuff called tartan, which is supposed to have been first made when the natives abandoned the practice of painting their bodies, together with a pretty close resemblance of the Roman garb, have been preserved by the Highlanders of Scotland to the present time. The culture of flax and manufacture of linen are also said to have been introduced by the Romans; and the natives were afterwards taught the art of weaving several kinds of cloth, chiefly for domestic purposes, by the Saxons.

Very little further is known relative to the progress of weaving in Britain, till the reign of Edward III. when several laws were enacted in favour of the woollen manufacture, and every possible encouragement given to foreigners by that monarch to settle in Britain, in so much that, from this period, the woollen manufacture has ever been considered the staple of England.

On the continent of Europe the cloth manufacture has been carried to a very great extent; in so much, that in the year 1305, the city of Louvain, in Flanders, with the adjacent villages, was said to contain 150,000 journeymen weavers; but which lost its manufactures about seventy years afterwards by an insurrection. In 1567, the persecutions under the Duke of Alva, in the Netherlands, drove many people into England, who introduced the manufacture of bazes, serges, and several other stuffs. But the great era in the history of the useful arts in Britain is about the years 1685 and 1686, when 70,000 refugees are said to have come over from France, on the revocation of the edict of Nantz, and brought with them an extensive knowledge of many manufactures with which we had been hitherto unacquainted. Of these, many went to Ireland, and numbers settled in Spitalfields, London, where they established the manufacture of silk.

The cloth manufacture made very little progress in Scotland till after the Union. About the year 1759, a branch of the silk from Spitalfields was established at Paisley, when it was soon brought to such a degree of perfection, especially in the light and more fanciful fabrics, that Paisley silks obtained a preference in all the markets of Europe; and laid the foundation for that extensive branch of fancy weaving which has since spread itself over the west of Scotland.

About the year 1767, Richard Hargreaves, a weaver in Lancashire, invented the cotton jenny for spinning wool; and about two years afterwards, the late Sir Richard Arkwright applied power to the spinning of warps, which greatly accelerated the cotton manufacture in that part of England. The improvements which have been made in the different branches of the cloth manufacture since that period, would fill volumes to give them in detail. But although we may be led to contemplate the discovery of cotton-spinning as the foundation of this great source of national and individual wealth, yet we are not to forget how much the modern discoveries in chemistry have contributed to raise this immense superstructure. The improvements in dyeing and calico-printing, the complete revolution in the art of bleaching, the application of steam to many economical purposes, and the perfection of the steam-engine, by which the various departments and detached branches may be brought under the manufacturer's own immediate view; these have all been conducive, in an eminent degree, to the maturation of this vast system, and have given to the cotton manufacture a pre-eminence unknown in the history of commerce.

In the discussion of this subject we have divided the whole into three parts: in the first, we have taken a comprehensive view of the principles of the cloth manufacture, or that which constitutes more immediately the department of the manufacturer; the second contains the construction and use of the principal apparatus employed in weaving; and the third, an explanation of the various textures of cloth, and the peculiarities of their fabrication.

PART I. MANUFACTURING DEPARTMENT.

Chap. I. Of the Raw Materials.

The substances of which cloth is chiefly manufactured in Europe are, wool, silk, flax, hemp, and cotton. Hair is also sometimes spun and formed into cloth, and sometimes it is interwoven with linen or flaxen yarn, for covering the seats of chairs, sofas, &c.

Sect. I. *Of Wool.*

Wool is the natural covering of the sheep; it is called fleece-wool when shorn from the animal while alive; and skin-wool, if taken off the skin when dead. Skin-wool, however, is generally shorter than that in the fleece, which renders it fitter for the purpose of felting, than for the cloth manufacture. The sheep are commonly shorn about the latter end of June, that they may have had the advantage of sweating in the wool before this operation takes place: and if they are well washed, and kept in a clean and dry situation for two or three days previous to shearing, it will considerably enhance the value of the wool.

In England, where a much greater division of labour exists than in Scotland, the wool is generally sold in the month of July to the wool stapler, who separates or sorts each fleece into different kinds or degrees of fineness, and makes it up into packs of 240 pounds each; in which state it is sold to the wool-comber, or manufacturer, at prices proportionate to its quality. The wool is divided into three, four or five different kinds, sometimes more and sometimes fewer, according to its quality or the purposes for which it is intended. The finest wool grows on the shoulders and back of the neck, and the fleece is gradually coarser towards the breech and tail, where it is coarsest of all.

After the wool is stapled or sorted, it is well washed and scoured with soap and water, and sometimes with chamber-ley, to free it from such impurities as are naturally or artificially combined with it. For the finer kinds of cloth, the wool is commonly dyed in this state; the coarser fabrics, for the most part, being dyed in the piece. For mixtures or medley cloths, certain proportions of the wool are dyed different colours, which are well mixed and carded together; the requisite shade being previously determined by mixing small quantities together as a pattern.

The next process, whether the wool be white, coloured, or mixed, is to prepare it for combing or carding. It is laid upon a frame, the top of which is composed of cords, drawn tight between its sides, and beaten with switches or rods until its fibres are sufficiently opened for the operation of the combs or cards. The separation of the fibres for this purpose, however, is now generally effected by a machine called a teazer or breaker; and, to facilitate this and the subsequent processes, the wool is sprinkled over with oil, in the average proportion of one Scotch pint (two quarts) to the stone. This proportion, however, varies with the quality of the wool, the finer sorts requiring more than the coarser.

The operation of combing consists in working small parcels of wool between two instruments called combs, until it is perfectly fine, and its fibres, as nearly as possible, laid in one direction; after which it is taken off in small roves, or slivers, ready for the spinner. The comb is composed of a number of steel spikes, well tempered and polished, and set into a board with a handle, parallel to each other. The longest wool is generally submitted to the operation of the comb, and spun for warps to the finer kinds of goods; the shorter sorts being chiefly carded and made into wefts. The difference between the combs and cards, is, that the spikes of the former are long and straight, something like those of a flax heckle; but the wires of the latter are short and crooked, their inclination being all in one direction, and are fastened to the board by means of a piece of leather, into which they are previously inserted. In using the combs, they are heated to a certain temperature in a kind of pot or furnace made of clay, by which they pass more easily through the wool.

Such is the mode of preparing wool for spinning, when the business is conducted on a small scale; but, in large manufactories, the successive processes of teazing, scribbling, carding, slubbing, and spinning, are now commonly performed by machinery, the construction of which pretty much resembles those employed in the cotton manufacture. Scribbling, carding, and slubbing, are only three different stages of the preparation for spinning: the first makes the wool ready for the cards; the second forms it into small roves or rowans; and the last unites the rowans into one continued rove or sliver. The spinning apparatus is sometimes wrought by manual labour, and sometimes by the application of power; each machine containing a number of spindles, varying, in general, from 72 to 144.

Sect. II. *Silk.*

This substance is the production of the *phalena bombyx* or silk-worm, which is a large whitish caterpillar with twelve feet, from an inch and quarter to an inch and half in length, and about half an inch in circumference. It produces a butterfly of the moth kind, after it is protruded from the egg, which is about the size of a pin's head, and of a yellow colour; it undergoes several changes and assumes the form of aurelia, in which state it spins the ball or cocoon of silk from two little bags above the intestines, which contain a gummy fluid, in some of a cream, and in others of a yellow colour. The cocoon, when complete, has pretty much the resemblance of a pigeon's egg; and in this singular retreat, the aurelia remains about three weeks, when it becomes a butterfly, and eats its way out at the pointed end. Those which are destined for the use of the manufacturer, however, are not allowed to approach this state of perfection, for the aurelias are destroyed in the cocoon before they arrive at the butterfly state, by placing them in a warm temperature.

The silk balls or cocoons, which are brought into the market, are of various qualities. Those which are good are easily distinguished from the bad ones; they are small and firm, have a fine grain, are round at both ends, and free from spots. The bad kinds are the suffons, which are so loose as sometimes to appear transparent; the perforated cocoons, which have a hole at one end; and the bad choquette or spotted cocoon; and these are generally broken down to make flock, or carded and spun for some of the stouter branches of the silk manufacture.

The cocoons are prepared for reeling by stripping off the waste silk with which they are usually covered. They are put into coppers nearly filled with water, and a fire kindled below them; the water is made as hot as possible without boiling, to soften the natural gum or gluten which covers the silk. The cocoons are then brushed over with a kind of whisk, to which the remaining loose threads adhere, and the silk is left clean for winding off. To the edge of each copper is fixed a plate of iron, perforated with a number of holes, equal to the number of hanks of the silk which are wound on the reel. Four or more ends or threads are put together, according to the intended fineness of the silk, and taken through each of these holes, when they are carried over hooks to raise them to the proper height, and fixed to the reel. When any of the cocoons run out or break, their places must be supplied with others, or the ends again united. The reeler is always provided with a bason of cold water, to cool her fingers when she has occasion to put her hand into the copper, or to prevent the water in the copper from coming to the boil. The water in the boilers must be changed frequently, as the refuse of the cocoons would soon sully the silk.

The silk may be thus produced of any requisite size, but the process becomes difficult when more than twenty ends are put together for one thread; for the greatest care is necessary to reel it evenly, and preserve the threads of an uniform thickness, by supplying the places of those that run out or break. The size of the silk is then distinguished by the number of cocoons of which it is composed; as silk of three cocoons, silk of six to seven cocoons, &c. and when it is coarse; we have silk of twelve to fifteen, or of fifteen to twenty cocoons.

The length of thread in each cocoon is very different, some being so long as 500 or even 600 ells, while others scarcely exceed 200; but on an average they may be computed to yield about 400 ells. The silk, when reeled, is tied into hanks, but it is not divided into any determinate number of threads. It is given to the winder by weight, adequate allowance being made for waste, and the fineness of the silk or value of the materials may be easily ascertained by weighing the chain after it is warped.

What is usually called tram silk, or Piedmont silk, from the place whence it is brought, consists of two threads twined together, each of which is originally composed for the most part of three ends or cocoons; this kind of silk is chiefly used for the warps of the finer species of gauze and nets, when a considerable degree of strength is requisite. Thrown silk is generally composed of from eight to twelve, or more ends or cones of single silk laid loosely together, and afterwards thrown or twisted by a machine, which gives it strength sufficient to bear the process of whitening. This is used for warps of the coarse or stouter kinds, for woof, and for spotting or ornamenting some of the finer textures. Waste silk, and silk rags, which are gathered on the continent in great quantities, are also cut down, carded, and spun into threads by machinery, and form a very useful material for the warps of shawls, plaids, and other stout fabrics.

Sect. III. *Flax.*

This plant is too well known to require a particular description; when ripe, it consists of a fine bark covering or green sap, below which are the fibres or filaments that are spun into yarn, and these, again, cover the woody or semiligneous parts. When the fibres are separated from the other parts by steeping and beating in the mill, as described under the head Bleaching, it is next submitted to the operation of heckling. This process consists in combing or drawing the filaments, which are now mostly separated from the other parts, through a group of finely polished steel spikes placed in a board with their points upwards. Heckles are of different sizes or degrees of fineness, and the flax is wrought first on the coarsest, and then on the others in succession. The process of heckling separates the fibres still farther into minuter parts than could be effected by the mill, and also detaches the fragments of wood which had escaped that operation. The hecklers likewise separate the coarse parts of the flax called tow, which are afterwards spun and woven into different kinds of goods for domestic use.

As hemp, in its nature, has a very close analogy to flax, the processes which are employed in preparing the latter for spinning, apply in every respect to the former. It is only the finer sorts of hemp, however, that are manufactured into cloth, the coarser kinds being chiefly appropriated to the making of cordage; and although it cannot be brought into so fine fabrics as the flax, yet it is incomparably stouter, and equally susceptible of bleaching; and what is a farther recommendation, the colour of cloths manufactured from hemp improves by wearing, while that of flax has a tendency to decay.

Sect. IV. *Cotton.*

This is the down or fine filamentous substance which envelopes the seeds of the genus gossypium, or cotton tree, of which there are said to be ten different species. Cotton is cultivated in the east and west Indies, in the warm climates of South and North America, in Africa, and in the southern parts of Europe. Its qualities are extremely various, but, when taken collectively, they afford every desirable means of diversifying our cloth manufacture. The finest cotton which is manufactured in this country is brought from India under the name of Bourbon wool. It has a fine strong fibre, and is used only for the finest species of goods. West India wool is of a coarser quality, though in this respect it varies considerably. Its fibres are, in general, pretty long and stout, which adapts it peculiarly to the strong and coarser branches of our manufacture. The cotton which is cultivated on the continent of South America is superior to that brought from the West Indies, and, in general, ranks next to the Bourbon. The principal kinds are, the Brazil, which includes the Pernambuco and Maranham; the Demarara, Surinam, Berbice, &c. These wools, as may naturally be expected, are of very different qualities; but the Pernambuco is superior to any imported, the Bourbon and Georgia excepted. The cottons of Georgia are also of superior qualities, particularly that called Sea Island. The bowed Georgia is rather an inferior kind. Considerable quantities of cotton-wool were formerly brought from Smyrna; but as this cotton has a very weak short fibre, it is now very little, if at all in demand.

Cotton-wool requires very little preparation for spinning after it is separated from the pods, except picking or cleaning it of the seeds or gins. The usual method of cleaning cotton in the West Indies and America, is by a machine called a roller-gin. This machine consists of a pair of fluted rollers, about nine inches in length, and 5-8ths of an inch in diameter, fitted with cranks and a fly-wheel, which are put in motion by the hand or foot, and sometimes by the power of horses. The cotton is separated from the seeds, by passing it through between the rollers. What is called bowed Georgia cotton, was formerly cleaned by means of a bow, the string of which being made to vibrate by the hand, struck upon the cotton, and separated the gin and opened the wool, in the same manner as the natives of India prepare their cotton for spinning. The bow, however, has for a considerable time been superseded in Georgia, by a machine called a saw-gin, which derives its name from the resemblance which the teeth that separate the cotton have to those of a saw.

When the cotton has been thus cleaned from the seeds, it is packed up in bales, into which it is compressed by means of a screw press; and in this state it is brought into the market.

Chap. II. Principles of Cloth Manufacture.

Sect. I. *Gristing Yarn.*

We are now to consider the materials of which cloth is fabricated in the state of yarn, and under the immediate management of the manufacturer, whose

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first care is to see that his yarns are properly sorted into parcels or bundles of the same uniform grist or fineness. That which is spun by machinery is all gristed and put into bundles at the mill, with its fineness marked on the wrapper; but, with respect to linen-yarn, or such as is spun by individuals, and collected promiscuously in small quantities, this task usually devolves on the manufacturer. Yarn is now commonly gristed by means of an instrument called a quadrant, which consists of a brazen quadrantal rim attached to a standard, on which the ounces and subdivisions of an ounce are engraven; and when the hank or other quantity of yarn is put into the scale which is appended, an index is turned round, which instantly points out its weight.

Linen-yarn, and also such woollen-yarn as is spun in Scotland, is wound on a reel $2\frac{1}{2}$ yards, or 90 inches in circumference, and tied into cuts of 120 threads each. Two of these cuts make a heer, and six heers tied together make a hank; so that 24 heers, or four hanks, make a spyndle. The cotton-reel is 54 inches in circumference, and the yarn is tied into skains of 80 threads each, seven of which make a number, and 18 numbers one spyndle. The grist of linen-yarn is generally expressed by the weight of a spyndle, or half-spyndle; though sometimes, but seldom, by the number of heers in a pound. The fineness of cotton-yarn, except when very coarse, is always known by the numbers in a pound. Hence, by comparing the spyndles of linen and cotton together, it will be found that the latter exceeds the former in the ratio of 21 to 20. Silk, as already observed, is not divided into hanks of any determinate quantities; so that its grist is usually ascertained from the number of cocoons of which it is composed.

Sect. II. *Reeds.*

The reed is an implement with which the weaver, by fixing it in a frame that swings on pivots, called the lay or batten, strikes up his woof to the requisite degree of closeness. The reed is also the scale by which the manufacturer determines the fineness of his cloth; being so constructed, that a certain number of warp-threads may always be compressed in a given breadth of the web.

For the principal manufactures of Scotland, the scale of reeds is regulated by the number of splits or dents contained in the Scotch ell of 37 inches. The splits in this space are divided into hundreds, the number of which in any reed is called its sett; and each hundred is again divided into five parts, called porters, which, consequently, contain twenty splits. Reeds made for Hollands and cambrics, which were formerly very common in Scotland, had scales peculiar to themselves; the former being constructed on 40 inches, and the latter on 34, which corresponded to the breadths of their respective fabrics.

In England, the scales of reeds are different from any of the preceding. What are denominated the Manchester and Bolton reeds are counted by the number of dents, or splits, in $24\frac{1}{4}$ inches, and are divided into beers, (porters) which contain sometimes 19, but more frequently 20 dents. The sett or fineness of the Stockport-reed is known by the number of ends or threads of warp in an inch; and as two ends are equivalent to one dent, the fineness of the reed is expressed by the number of dents in two inches. There are several species of goods, however, woven in reeds constructed on 36 inches; and, indeed, each of these scales seems to be adapted to peculiar kinds of cloth, as was formerly the case with respect to the Holland, cambric, and lawn reeds in Scotland.

The fineness of any piece of cloth, therefore, takes its denomination from the sett of reed in which it has been woven, without any regard to its breadth or the quantity of warp it may contain; for when the cloth is intended to be broader or narrower than the standard, proportional parts must be added or subtracted, to give the requisite quantity of warp. Thus, the standard for Scottish reeds is 37 inches, which is divided into 16 parts called nails; and the breath of a web is generally expressed by the number of nails or sixteenths which it fills of the reed. Hence, to find the quantity of warp for any other breadth of a given sett of reed, we multiply the splits in 37 inches by the nails in the breadth, and the product, divided by 16, gives the answer. For example, if we want to know how many porters are in a piece of cloth 18 nails, or 9-8ths broad, and woven in a 12 hundred reed, we say $\frac{1200 \times 18}{16}$, or $\frac{1200 \times 9}{8} = 1350$, which, divided by 20, gives 67 porters, 10 splits. The same is to be understood of the other scales of reeds.

The number of the reed in which any piece of cloth has been woven, is generally ascertained by the help of a small instrument called a web-glass. It consists of a magnifying glass fixed in a brass-stand, at the focus of which is a plate perforated with holes, adapted to the different scales of reeds. When the holes are adapted to the reeds used in Scotland, they are of such a size, that we can count one thread of warp for each hundred or sett of the reed; but in England they are usually adapted to the number of threads in an inch, or some part of an inch.

Sect. III. *Caaming, Sleying, or Setting.*

These terms are severally employed to denote the proportioning of the grists of yarn to the different setts of reeds, to produce a uniformity of fabric in the same species of cloth. In order to explain what is meant by the word fabric, let us suppose, for example, that a piece of cloth is woven in any sett of reed, as a 1200 or 37 inches, and that the diameters of the warp threads, and the small spaces between them, are exactly of the same dimensions Then, if we have another piece of cloth of the same texture, woven, for example, in an 1800 reed, the diameter of the warp-threads being also equal to the intervening spaces, then two sizes of cloth are said to be of the same fabric, although the one is a third finer than the other; so that, when the diameters are greater than the spaces, the fabric is proportionally stouter, and the reverse when they are smaller.

Now, the method of determining the several grists of yarn that will preserve this uniformity of fabric, through the different sets of reed, for the same species of cloth, is what is meant by caaming, setting, or sleying, and which depends on the following analogy:

As the square of any given reed:
To the square of any other reed::
So is the grist of yarn that suits the former:
To the grist of yarn that will make the same fabric in the latter.

Example. Suppose No. 72 cotton will make warp for a 1200 jaconet, it is required to find the numbers of the warp that will suit a 1600 of the same fabric? Here we have 144, the square of 12 to 72; as 256, the square of 16 to 128, the numbers of the yarn required.

The reason of this rule will appear by considering the threads of warp, when stretched in the loom, as so many cylinders of equal length or altitude, and the reed as the scale which measures the space in which a given number of these threads are contained; therefore, the solidities of the threads in one sett of reed, will be, to the solidities of those in any other sett of reed, as their cases, or, which is the same, as the squares of their diameters, by p. 11. b. 12. of Euclid. But the weights of the cylinders, or threads, supposing them of the same density, will be as their solidities; and a determinate number of splits of the reeds, or rather the intervals between them, may be substituted for the diameters of the threads which pass between them: therefore, by the last analogy it will be as the square of the number of splits in the reed, to the known weight or grist of yarn; so is the square of any other number of splits, occupying the same space, to the weight or grist of yarn that will produce the same fabric in this reed; which is the rule given above.

We have made the supposition that the threads of warp are all of the same density, which may in some instances appear not to be the case, owing to the difference of twist they may have received in spinning; but when the warps are tightly stretched in the loom, and all their loose fibres compactly laid by the weaver's dressing, their densities, though perhaps not mathematically the same, will be sufficiently near to answer every practical purpose of the manufacturer.

The following are a few examples to illustrate the principles of caaming:

1000 Book muslin, warp from No. 82 to No. 110; weft, No. 90 to 116.
900 Cotton gauze, warp about No. 90, weft very little finer.
1300 Cotton-shirting, warp No. 24, weft 38.
1200 Pullicate, warp No. 50, weft about the same.
1200 Gingham, warp No. 36, weft No. 40 to 44.
1600 Cotton-cambric on 37 inches, warp No. 70, weft 96.
1600 Ditto ditto on 34 inches, warp 75, weft 104.
1100 Cassie, warp No. 52, weft about the same.
1500 Linen, on 40 inches, warp 8 oz. per hesp, weft 7 oz.
1600 Linen cambric, on 34 inches, warp $5\frac{3}{4}$ oz. per spyndle, weft 5 oz.
1200 Clear lawn, warp 2 oz. 10 drs. per hesp, weft 2 oz. 6 drs.
2200 Holland on 40 inches, warp 8 oz. per spyndle. weft 7 oz.
1400 Shirt linen, warp 6 oz. per hesp, weft 5 oz.
600 Linen gauze, warp $4\frac{4}{8}$ oz. per hesp, weft 5 oz.

SECT. IV. *Boiling, Starching, and Sizing Warps.*

The vegetable substances, flax, hemp, and cotton, when made into warps, require the process of dressing in the loom to lay their fibres and increase their tenacity. The animal productions, silk and wool, are generally woven without this process. Yet, as woollen yarn is spun from the comparatively short fibres of the wool, there are always some of the fibres whose ends are not sufficiently incorporated by the twist, and which would considerably obstruct the weaver's progress, were they not laid smoothly to the body of the threads by some glutinous substance. In order to render the vegetable substances susceptible of imbibing the dressing, they must undergo a preparation, for the purpose of opening their fibres, and discharging the oil and other substances with which they are usually combined, without affecting their cohesion. For linen yarn this process is called boiling, and is generally conducted as follows:

The yarn is tied up in handfuls of three or four hanks each, and laid in warm water to steep for a night. After it is well rinsed and wrung, it is put into a boiler with a quantity of pot ashes, and water sufficient to cover it. It is allowed to boil about two hours and a half, during which the yarn is frequently stirred with a stick, to prevent its adhering to the bottom. The quantity of ashes generally used is one pound to every six pounds of yarn. Rather more than the half, however, is only put in at the first boiling. The yarn is then taken out of the boiler, rinsed, wrung, and spread on the green, when it is bleached for two or three days. It is again boiled with the remaining part of the ashes, and, after rinsing and wringing, it is laid on the green for two or three days longer, and kept constantly wet. It is now well rinsed, wrung, scutched, and hung upon poles to dry, during which it is frequently turned and shaken, to render it free and open. Some add a little soap at the last rinsing, but this is proper for wefts only, as it would deprive the warps of that roughness or friction which retains the weft threads in the situation into which they are driven by the reed while the weaver is at work.

The process of boiling discharges a considerable quantity of the colouring matter as well as the saliva which is combined with it in spinning, by which it is brought nearer to its real grist; and therefore, the better this operation is performed, the less will those fabrics, which are intended to be stout, be reduced in the subsequent process of bleaching.

Linen-yarn, from the long and tenacious fibres of which it is composed, is rendered fit for warps merely by the process just now explained. Cotton-yarn, however, being made of more slender materials, requires the addition of some viscous substance to preserve or increase the tenacity of its fibres. After it has been well boiled in water, with the addition of a little alum and ashes, if soft or mull-yarn it is wrung out, and then well soaked in a thin paste or mucilage, composed of flour and water boiled together. Starch was formerly used instead of flour, especially for fine yarns, from which the process derives its name. The yarn is then wrung, or pressed, and hung on poles in a stove to dry. While drying, it must be

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frequently turned and shaken on the poles, to prevent the threads from adhering together.

This process refers to yarn in the hank; but in large manufactories, where the yarn is generally wound directly from the cop on which it was spun, the process of starching does not take place until it is warped, and then it is starched in the chain. The chains are boiled as already described. They are afterwards wrung by means of a screw-press, or by drawing them through between two wooden rollers. They are then soaked in the mucilage, and drawn through a hole smoothly cut in a board of hard wood, which serves the purpose of wringing without endangering the warp. There are several holes in the board, of different dimensions, to suit the size of any particular chain. The chains are then hung on poles in the stove, and, when dry, they are rolled up in form of a clue, in which state they are delivered to the weaver.

The process of sizing woollen warps is equally simple. The yarn is first scoured, and then soaked in a solution of size in warm water. The size employed for this purpose is that made of skinners, tanners, or curriers refuse. It is boiled in water, and the yarn put in while as hot as can be handled. When wrung out of the size and dried, it is ready for the winder.

Sect. V. *Winding.*

This simple operation consists merely in winding off the yarn from the hank or cop, upon bobbins, for warp, and on pirns or quills for woof. Yarn, which is reeled into hanks, is still wound by the single thread-wheel, and whisks, which are of different forms and sizes, to suit the several species of yarn to which they are adapted, and with which it is unnecessary to trouble the reader with any description. The only improvement which has been made in this stage of the manufacture is the invention of machines for winding a number of bobbins at once off the cops. These machines are also of various constructions, some of which are driven by power and others by the person who superintends the bobbins. The last are of most general use, and are to be found in almost every extensive manufacturing warehouse.

One of these machines, on the most recent and improved construction, is represented in Plate 43. Figs. 1. and 2. AA is the frame, which is sometimes made of wood and sometimes of cast-metal. B is a board, extending the whole length of the machine, and is fixed to the treadles *a*, *a*, by which the winder puts the whole in motion with her foot. The motion is communicated by means of the crank *b* to the sheet-iron cylinder *x*, round which are the cotton-bands which drive the bobbins. On the axle of this cylinder, at the opposite side, is the fly-wheel C, for regulating the motion of the machine. The bobbins, *i*, are fixed on their spindles *z*, and the cops are placed on their skewers at *u*. D is a trough, in which the roller *o* revolves by means of the bevel wheels *e*. These are put in motion by an endless screw on the axle of the cylinder *x*, turning the spur-wheel *n*. *m* is another spur-wheel, working in the same endless screw, and turning, by the bevel-geer *w*, the spindle or small shaft *p*, on which is a heart traverse *g*, similar in form to that represented at M. By the revolutions of this traverse, a motion is communicated, by means of the lever *r*, to the conductor, *s*, in such a manner that it is accelerated at the top and bottom of the bobbin, and retarded about the middle, by which it assumes the form of a barrel; *q* is a weight for balancing the conductor. The threads pass from the cops over the roller *o*, and after they are taken round the hook *y*, they are carried over the conductor to the bobbin. In the trough D there is always a little water, which generates a small degree of friction as the threads pass over it, and prevents them from winding too slack, or from running into snarles on the bobbins; *h* is a box for holding cops or empty bobbins. These machines, when conducted by one person, are generally constructed to wind thirty-six bobbins at once. Sometimes, however, they are made double, with thirty-six bobbins on each side; but in such cases they are always attended by two winders. One girl, on a single frame of thirty-six bobbins, will wind from 70 to 80 spyndles of warp in a day.

Sect. VI. *Calculation of Warps and Wefts.*

It has been already observed, that a spyndle of yarn, wound on a reel of 90 inches in circumference, contains 48 cuts of 120 threads each; and as this is exactly double the English ell, or 45 inches, by which the warps of webs are usually measured, and two threads being accounted one split—it follows, that the spyndle of linen or woollen so reeled will contain exactly 48 times 120, or 5760 splits, one ell in length. These divided by 20, give 288 for the porters or beers in one spyndle, which is always a given or fixed number in the calculation of such warps. The requisites, therefore, in these calculations, are the number of ells in the length of the web, the number of porters in its breadth, the spyndles of warp, and the number 288; any three of which being given, the other will be found by varying the following proportion:

As the porters in one spyndle, viz. 288 :
To the porters in the web : :
So the ells in the length :
To the spyndles.

Example. Let it be required to find the number of spyndles requisite for 100 ells of a 1200 $\frac{8}{8}$ths broad jaconet. Here we have given 100 ells, the porters = $67\frac{1}{2}$, and the number 288. Therefore,

$$288 : 67.5 :: 100 : 23.43 \text{ spyndles.}$$

This calculation is made for the net-warp on $\frac{8}{8}$ths; but as almost every kind of cloth will sink less or more in the breadth when taken out of the loom, or in the bleaching, &c. it is necessary to make a suitable allowance to the warp for this purpose; which will, in general, depend on the fabric of cloth, and the tendency it has to shrink in its subsequent operations, as will be peculiarly observable in those woollen goods which have to undergo the process of fulling. It is further to be remarked, that since yarn of every kind is liable to some waste in the several processes of reeling, winding, and warping, an adequate allowance must likewise be made for such deficiences, which, in general, is taken at about 5 per cent. The spyndle of cotton, however, exceeds the spyndle of linen exactly by this quantity; and therefore it may be presumed, that when the cotton-reel is of full length, and the yarn well told, it should require no such allowance when calculated by the preceding rule. This, however, is not always the case; and a small allowance is usually given, which, for the most part, depends on the quality of the warp, or the preparations it has undergone.

There are several rules for finding the quantity of weft on any piece of cloth, by the help of the web-glass; but that which is generally practised is, by finding the quantity of warp in the piece; and adding or subtracting proportional parts, according as the number of shots on the glass exceeds or falls short of the sett of reed.

Sect. VII. *Warping.*

Having determined the quantity of warp requisite for any web or piece of cloth, it is given to the warper along with a ticket, expressing the particulars relative to the chain. If the cloth is to be striped with yarn of different colours, or degrees of fineness, the pattern is also marked on the ticket, for the warper and weaver's instruction.

The bobbins being placed in the bank A, Fig. 3. Plate 43. and the ends taken through the eyes of the heck, *a*, they are knotted together, and placed on the upper pin of the mill *e*. The lease or sheds for the rods is then formed, by raising first one part of the heck, and then the other, securing the two sheds on the middle finger and thumb of the left hand, until they are placed on the upper lease fork at *i*. The threads are now divided into small parcels of about 10 to 20 each, according to the quantity or fineness of the yarn in the piece; and these are kept separate by the small rollers *o*, on the frame of the heck, and which are denominated *half-gangs*, or *half-bouts*. A representation of the heck, on a larger scale, with one part raised to form a shed, will be seen in Fig. 4. The warper now turns the trundle B.; and as the mill goes round, the cord *u* unwinds from the axis at *v*, and lowers the heck gradually, by which the warp is laid on the mill in the spiral form exhibited in the Figure.

As the circumference of the mill measures commonly either four or five ells, every turn of the mill will add so much to the length of the chain; and when the warper has ascertained the given length on the mill, he adds a small part for a thrum; then fixes the under fork *x*, on which he turns the half-gangs, crossing them individually between the pins; after which, he turns the mill in the contrary direction till he arrives at the upper lease pins, when he forms a new lease. This process he repeats until the whole chain be completed, which he determines by the following calculation. As each split in the chain is equivalent to two threads of warp, it is evident, that one bobbin or runner, taken down the mill and up, will be equal to one split. Therefore, when the whole number of splits in the web is divided by the number of bobbins or runners, the quotient will give the number of mill-gangs, or bouts requisite for the chain; and when a fractional part remains, he cuts away part, and runs another bout with what will make up the deficiency. When the chain is complete, the warper puts on his single and double marks; the former to shew the weaver what progress he makes, and the latter where the pieces are to be cut.

In warping striped chains, some attention is necessary to preserve the setts of the pattern entire; and this is best effected by turning the gang or bout on the centre of a stripe. This is peculiarly requisite in warping pullicates, where there is generally a great diversity of stripes; but the knowledge of this branch of warping is best acquired by practice.

Before the warping-mill was common, it was the practice to warp the chains on pins stuck into a frame, or into the wall, by carrying a number of threads round them in the manner of a mill-gang; and this was taken from pin to pin, until the chain was of a sufficient length; and was repeated until the requisite quantity of warp was wound on the pins, the lease being always lifted by the hand. This method of warping, however, is entirely superseded by the mill, except in some of the branches of the woollen manufacture, where the materials are too bulky and ponderous for a moveable apparatus of moderate extent.

Fig. 5. is a machine lately invented for warping whips, or those loose threads which form the figures of lappets. These chains, in general, contain but few threads; but they are of a great length, sometimes ten or twelve hundred ells. The common warping mill, therefore, was very inconvenient for this purpose, and gave rise to the present simple invention. The bobbins on which the whip is wound are placed in the bank A, which is here seen in profile, and the ends taken through the heck *a*, and afterwards through a hole in the plate of iron *b*. They pass over the upper roller towards *e*, then through between them to *i*, back again towards *o*, and, lastly, descend into the tin box *u*. The machine is turned by the winch *x*, and the whip is drawn through by the pressure of the rollers. At *w*, there are two brass wheels, and a pinion, driven by an endless screw on the axis of the winch *x*, which, by their revolution, point out the number of ells in the chain as the warping proceeds.

Chap. III. Application of Power.

We are now arrived at that stage of the cloth manufacture which requires the act of the operative weaver; but as this department is fully discussed in the subsequent parts of this treatise, we shall direct our attention in this place to some of those modes of economy which have been lately introduced by the application of power. In a subject which admits of so much scope for invention, it is natural to suppose that a considerable diversity will exist in the constitution of the apparatus necessary for this purpose. We shall, however, confine ourselves to the description of such as, from extensive practice, have been found completely adequate to the end for which they have been invented. The drawings of the warping, dressing, and weaving machines, have been taken from the extensive works of Messrs Muir, Brown, and Company, of Glasgow.

Sect. I. *Warping by Power.*

This mode of warping is applied, exclusively, to

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As the fast and loose pulleys are commonly employed for engaging and disengaging this species of machinery, it may be proper to take some notice of them here, to avoid repetitions in the subsequent descriptions. The pulley *x* is fixed on the axle *a*; so that while the band or belt is on this pulley, the machine is in motion; but when the band is thrown over on the pulley *w*, which is loose on the axle, the machine stops, and the pulley alone turns round with the band. The manner in which the band is shifted from one pulley to the other will appear at A, Fig. 7, and the supplementary Fig. N. On the end of the rod *h* is a fork *k*, which embraces the band *k*, in the Fig. N; and the person who attends the process has only to move the rod *h* with his hand to one side or the other to put on or take off the power.

Sect. II. *Dressing by Power.*

When a sufficient quantity of warp has been wound upon four of these rollers in the manner above described, they are placed in the dressing machine at E, with the weights *w*, suspended by cords passing two or three times round the rollers, to keep the warp duly stretched. The ends of the warp-threads are first taken through the reeds *a*, *b*, *c*, and then, after passing under the rollers *d d*, the whole is wound in the dressed state on the upper roller *e*, which is the yarn-beam of the power-loom. As the warp proceeds by the motion of the machinery from E to *e*, it turns round the rollers *m*, *m*; and as there is a quantity of dressing previously put into the troughs *n*, *n*, part of it adheres to the circumference of the rollers as they revolve, which is again communicated to the warp. In order to regulate the quantity of dressing thus raised by the rollers, there are, in some machines, other rollers covered with leather revolving above them, and the pressure between their surfaces, by which the quantity of dressing may be increased or diminished, is adjusted by levers, on which are suspended moveable weights. In other machines the same is effected by the pressure of cushions placed in the boxes *n*, *n*. Machinery.

The motion is communicated to the machine by the fast and loose pulleys *x*, on the axle of the bevel wheel *v*; and this wheel gives motion to the shaft *z*, on which there is a triple speed, for accommodating the motion to the yarn-beam *e*, at the different stages of the process. These speeds are changed by raising or lowering the wheel *s*, on its spindle. The shaft *z*, likewise gives motion to the circular brushes *y*, *y*, *y*, *y*, by means of the bevel-wheels on their several axles, as represented in the Figure. The fans *p*, *p*, for drying the warp, are put in motion by bands running over pulleys on the opposite ends of their respective axles, communicating with the fast and loose pulleys. As the fans, however, are not always sufficiently powerful, to dry the warp before it reaches the beam *e*, a quantity of steam is introduced, by means of a stopcock, into the stove *u*, which is composed of two metallic cylinders with communications between them, to increase the warming surface. Below each of the circular brushes *y*, is a straight one, *i*, for clearing off the dressing and loose fibres which are brushed from the warp. At *h* is a frame for holding a set of plain heddles, which are necessary to produce a lease for the rods; and at *g* is another frame, on which is another reed, which keeps the warp clear and regular, as it goes on the beam.—*k*, *k*, are rods which, together with the reeds *a*, *b*, *c*, serve to keep the warp clear, as it advances through the different stages of the process.

It has been already observed, that there are various forms of the machinery for the preparation of warps and weaving by power. This is particularly the case with respect to the dressing machine. There is one, however, though constructed on a very different principle, which executes the work in every respect as well as the one here described. The brushes are not circular, but flat, like those used by weavers, and extending from one side of the web to the other; they are fixed in frames so constructed that one moves on the upper surface of the warp, and the other below, alternately imitating, in great perfection, the motion of the weaver's hands. But any particular description of so complicated a piece of mechanism, without the aid of drawings, would be totally unintelligible, and we have trespassed too far on our limits in this respect already.

Sect. III. *Weaving by Power.*

A front elevation, and profile view of a Power-Loom is seen in Fig. 1. and 2. Plate 44. The roller or beam on which the warp is wound in the dressing-machine, is placed in the loom, Fig. 2. at A, and the warp is either twisted to a thrum that was left in the heddles, *e*, *e*, from a preceding web, or drawn anew, as in the common mode of weaving; the lease being

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preserved by the rods a. It is then taken through the reed, which is placed in the lay or bottom B; and, when woven into cloth, it is wound upon the beam C. The power is communicated to the machine by a belt on the fast and loose pulleys D, on the axle of the spur-wheel i, but on the opposite side of the loom. The reciprocating motion of the lay, B, is effected by means of the rod u, which connects it to the rim of the wheel i, in the manner of a crank. There is one of these rods on each side of the loom, that on the opposite side being attached to a crank. The wheel G, on the axle of which are fixed the two wipers, or excentric wheels, o, o, is driven by the wheel i; and, in its revolutions, the wipers press down the treadles x, when they come in contact with the friction rollers v; the two treadles, 2, 3, Fig. 1. being destined to move the heddles and open the sheds, and the other two, 1 and 4, to drive the shuttle. The two wipers, o, o, act by their circumferences on the treadles 2, 3; and as certain portions of these circumferences are circular at their greatest distance from the centre, the motion of the heddles is thereby suspended while the shuttle is pressing through the warp. To the exterior side of each wiper is screwed a circular knob, moveable on its axis, which, when it strikes the friction-roller of its respective treadle, gives the corresponding motion to the shuttle. This motion is communicated by means of a belt fixed to the pulley z, and also to the two outward treadles 1 and 4; and the drivers receive their impulse from the driving pin attached to the pulley by the connecting cords y, y. It must be observed, however, that the knobs must be so fixed to their respective wipers, that the sheds may be sufficiently opened by the centre treadles before the shuttle receives its impetus; and this may be effected by shifting them backward or forward in grooves cut in the wipers for this purpose, and adapted either to the open or close shed before they are fully screwed.

The apparatus which winds the cloth upon the roller as it is woven, will be seen at F, Fig. 2. It consists of the spur-wheel F, on the axle of the cloth-beam, which is driven by a pinion on the axis of the ratchet-wheel s. This wheel is turned round by the lever g, on the top of which is a catch working in its teeth. The lever g, has a reciprocating motion given to it by a stud in the sword of the lay at r, which will be seen to more advantage in Fig. 1. As this catch, however, is moved by every stroke of the lay, it cannot command a tooth of the wheel at each shot; it therefore reciprocates over one tooth until as much cloth is woven as will permit it to lay hold of another; and this being secured by the other catches exhibited in the figure, the reciprocations are continued.

But the most ingenious contrivance in the whole machine, perhaps, is that which causes it to stop of itself, when the shuttle meets with any obstruction. This is effected by means of a circular piece of wood in the back of each box that holds the shuttle, which is acted upon by a spring behind, and communicates with a plate of iron that is moveable in front of the lay. In the breast-beam, Fig. 2. is a stud, n, projecting from the other end of the lever e, Fig. 1. which is moveable behind the cloth. Opposite to this stud is another plate of iron, with a hole in it sufficiently large to admit the stud without any obstruction. Now, when the shuttle is lodged in either box, it presses back the circular piece of wood, and raises the first mentioned plate of iron off the hole in the second, and permits the stud n, to pass freely through, and, consequently, the lay to strike up the weft. But should the shuttle stick in the shed, or be thrown off by broken threads entangling the warp, the plate which is connected to the circular pieces in the boxes remains over the hole in the other, and strikes against the stud n with all the force of the lay, which causes the other end of the lever e, to disengage the spring A from the catch, and stop the machine.

In this loom, it will be observed, that the lay moves on centers below; but in some others it is so constructed as to move upon iron rods, one at each side of the machine. This loom, however, is preferred by many on account of the smallness of the friction generated by the reciprocations of the lay. There is another beam in which the lay is drawn back by a wiper acting on a treadle, but which strikes the cloth by means of weights attached to it, and running over pulleys in front. In all these looms the general principle is nearly the same; but there is one more that we shall just mention, which was invented by Mr Johnston, with a view to weave two webs at the same time. In this loom the reciprocating motion of the lay is vertical, and that of the heddles horizontal. Consequently, the race of the shuttle is along the upper surface of the reed. This loom was introduced into Glasgow some years ago, but it has now fallen so far into disuse, that we believe there is not one at present working either in Glasgow or its vicinity.

Sect. IV. *Incle or Tape-weaving.*

The weaving of tapes, though hitherto conducted by manual labour, is still so far a mechanical process as to bring it with more propriety under this head than under that of practical weaving.

This branch of manufacture was introduced into Scotland about 84 years ago by a Mr James Harvey, who went to Holland for the express purpose; and, having made himself acquainted with its principles, he found means to convey one of the looms over to Glasgow, where a tape manufacture was first established, and where the original loom still forms a part of the apparatus.

Tapes are now commonly made of linen warp and cotton weft; though originally they were entirely made of linen yarn. The warp of each tape is wound by a wheel on a large bobbin, which is placed in the loom at a and e, Fig. 3. Plate 44.—the other two rows of bobbins i and o, being destined to receive the cloth after it is woven. From the bobbins, the warp is taken over the cross bar of wood b, and passing over a small pulley at c, it proceeds round the under pulley u, over a larger pulley on the same axis with c, and down to the roller x, and thence through the heddles and reed, where it is fabricated into tape. After it is woven, it passes over the breast beam, and round the fixed rollers, or rungs, m, n, crossing as represented by the dotted lines in the Fig.; then by the two bars z and y, to the larger pulley at r, down to the pulley s, over the lesser pulley at r, and down to the cloth bobbins i and o, which are secured by small catches. The lever d is attached to the bowl g, in the manner of a crank, and also to the under part of the sword of the lay, as represented in the supplementary Fig. M. When, therefore, the weaver works the hand-roller h, backward and forward, the lay receives its reciprocating motion. On the axle of the bowl g is the fly-wheel B, and likewise the trundle p, Fig. 4. The trundle g drives the star-wheel w, on the axle of which are the treads f for driving the shuttles, and those at k for moving the heddles. On each of the treadles are friction rollers, as appears at N; l, l, are weights suspended from the heddles, to keep them duly stretched. D, D, are the flyers, connected to the heddle shafts; and behind the sword of the lay, at E, are the shed wires, which are fixed to the rocking-tree F, by belts, and which are also connected to the treadles, k, below. It is therefore evident, that as the star-wheel w revolves, the treadles k are acted upon by the treads, and raise the leaves of the heddles alternately, by which the sheds are opened. Fig. 5. and 6. are two different views of the shuttle. In Fig. 5. the pirn with the weft, and two small wire springs pressing against it to retard its motion, are represented. In the back part of the shuttle are two grooves, by which it is secured in the lay. The position of the shuttles in the lay will be seen at t, Fig. 4. Fig. 7. is a part of the lay on a larger scale. a, a, are the reeds through which the tapes are drawn, and x, x, are staples of iron, fitted to the grooves of the shuttles, and on which they are screwed, except while passing through the shed. The frame A, is attached to the front of the lay, with a stud A, projecting upwards, for driving each shuttle. In the pulley i is a stud, represented by a dot, which projects through the board k; and as this pulley is turned half round to each side alternately by the treadle f, it gives a reciprocating motion to the frame A, which drives the shuttles.

The tapes woven in this manner are narrow stripes of cloth, of the plain texture; but there is another kind woven in these looms, called bobbining, which is round like a cord. In weaving the bobbining, the shuttles pass through the sheds always in one direction, and return to their first station above the warps, while the succeeding shed is forming. This is effected merely by making the head w, Fig. 3. consist of eight spokes instead of four; and therefore the motion of the treadles f, that drive the shuttle, becomes double of those at k, Fig. 4. which move the heddles.

The different qualities of tapes and bobbining take their denominations from the number of threads which constitute their respective warps, and which number is always odd. Thus, Holland tapes are usually numbered 11, 13, 15, 17, 19, 21, 23, 25, 27; and 135, 139, 145, 151. These last four numbers, however, have a nominal 100 added; for they have only 35, 39, &c. threads of warps. In this series, number 25 is about half an inch broad, and the others in proportion. The common run of Holland bobbining is No. 5, 7, 9, 11, 13, 15, being composed of these numbers of warp threads respectively.

These, as already observed, are made of linen warp and cotton weft; but there is a finer kind manufactured, called imperial tapes and bobbining, which are about as fine again as the preceding. They are wholly made of cotton, their warps being two ends twisted together, and the weft single. There are, besides, baker tape, which is a still coarser kind than the Holland, and various species of striped tapes, generally made with blue and white warps and white wefts.

Chap. IV. Operations subsequent to Weaving.

Of the numerous processes which would fall to be discussed under this head, several of the most considerable will be found amply detailed, in separate articles, in the course of this work. There are a few, however, to which it is necessary to advert in this place, as they are, perhaps, more intimately connected with particular branches of the cloth manufacture.

Sect. I. *Fulling.*

The process of fulling or milling, in the woollen manufacture, consists in cleansing, scouring, and pressing or beating the stuffs; and which, by adding to the texture of the materials the properties and qualities of felting, render them much stronger and closer in the fabric. The principal part of this process is conducted by a machine called a fulling-mill which is the same with what is termed a wawk-mill in Scotland.

The pieces which are to undergo the process of fulling are made considerably longer and broader in the loom than they are to stand in the finished state. The lengths, in general, are from 24 to 36 yards, when they come from the loom, but they shrink to about 20 and 30 when finished; and the breadth sinks in proportion. Those goods which have been dyed in the wool go direct to the fulling-mill; but the white is first scoured and then dyed in the raw state, after which they are milled; and if the process be conducted with due attention, the colours will be equally fixed as those which were dyed in the wool.

The fulling-mill consists of a number of pestles or wooden mallets, which alternately beat the cloth; and which are kept in motion by the revolution of a cylinder connected with the moving power, into which are inserted an equal number of studs or wipers, which raise the mallets to a certain height, and then let them fall on the cloth by their own weight. The stuffs are usually prepared for fulling by laying them in urine, then in fuller's earth and water, and, lastly, in soap dissolved in hot water. The fuller's earth must be free from all stones or grittyness that would injure the cloth. It imbibes all the grease, oil, or tar that has been left in the wool, or which has been acquired in the preparatory processes. When the cloth has been sufficiently wrought in the mill, the nap is raised with cards, in the wet state; and, when dry, the nap is cut off with clothiers shears. This process, which is performed with shears similar to those employed in sheep-shearing, but larger, was formerly conducted by manual labour, with the cloth spread before the operator on a cushion made for the purpose; but now it is almost universally effected

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Sect. II. *Singeing.*

Many kinds of muslins, and other cotton goods, particularly corduroys, velveteens, &c. require the loose fibres which abound on their surface to be singed off, preparatory to their peculiar modes of dressing. This is effected by passing them swiftly over a red hot cylindrical plate of cast metal several times. The plate, which is a semi-cylinder, is built up with brick over a furnace, with the hollow side towards the fire. On each side of this apparatus is a frame with rollers, on which the cloth is alternately wound and unwound, as it passes and repasses over the heated metal. This process singes off all the fibres of the wool which have not been sufficiently incorporated with the texture, and renders the light kinds of muslins clear and almost transparent, when they are hard dressed with starch after bleaching. To cotton velvets, corduroys, &c. it gives that smooth and polished surface which we see in those goods, and which will be more fully explained in the following section.

Sect. III. *Finishing Corduroys, &c.*

When the web or piece is delivered by the weaver, it is given to a person whose business it is to cut up the flushing. This operation he performs, after stretching the piece upon a long table, by running a sharp-pointed instrument along each furrow below the flushed weft of each stripe, which cuts it equally between the edges. This instrument has some resemblance to a small sword, and is called a plough. The piece, when cut, is put through a brushing machine, when it is submitted for a considerable time to the operation of the brushes. In this machine two large brushes are driven, generally by a horse-power, alternately across the piece, which is previously spread upon a strong table, with its cut surface uppermost, and exposed to the action of the brushes. The cloth moves very slowly over the table, being wound on a roller at one end by the machinery, while it unwinds itself from another roller at the opposite side; and this process raises the pile, and forms the loose parts of the flushing into ridges over those parts where it is interwoven with the warps. The next process is singeing, which is explained in the last section. This done, the piece is immersed in hot-water, and brushed well again with a hard-brush. It is then dried and singed the second time, and again put through the brushing-machine. The operations of brushing, immersion in hot water, hand-brushing, drying, and singeing, are repeated three times in succession; after which the piece is put through what is termed a chemic; that is, hot water mixed with a little pearl-ashes, to which is added a small quantity of vitriol. It is then laid out upon the grass for two or three days; at the end of which it is again put into the ley or chemic, and rubbed well with the hand-brush to take out any brown or fire-stains that may be remaining in it. When it lies on the green two or three days longer, it is ready for dyeing dark colours; but for light colours it must receive a little more bleaching. Operations.

Sect. IV. *Ornamenting Cloth with the Needle.*

Independent of the ornamental, or decorative branches of weaving, which are fully explained in a subsequent part of this treatise, there are several other modes of adding ornaments to plain fabrics, which merit some attention in this place. Of these, that which has excited most interest in the cotton manufacture, and of which it now forms one of its staple branches, is the well-known species of chain-work designated tambouring.

This species of ornament, which derives its name from the tent or drum-like frame in which it was originally wrought, was first introduced into Scotland as a branch of manufacture about forty years ago, by two gentlemen from Switzerland, a Mr Raphin and a Mr Habic. Mr Raphin first established a school at Edinburgh for teaching young women this art; and Mr Habic, who had acted sometime as manager to Mr Raphin, erected another at Kilmarnock in the west of Scotland. It was first conducted as a business in the vicinity of Glasgow, we believe, by the late Mr James Monteith, Anderston, who was soon afterwards followed by the principal manufacturers in Glasgow and Paisley. Tambouring and hand-sewing have since been carried to an amazing extent in the cotton manufacture, and at present are the means of employing a very great proportion of the females of the middle and lower orders in all the towns and villages within fifty, and, in some directions, an hundred miles of Glasgow, who are each able to earn from 2s. 6d. to 5s. per week.

Processes.—The process of tambouring consists in forming a succession of loops upon the cloth with the tambouring thread, by means of a small steel-hook fixed in a handle, called a tambouring-needle. The cloth is stretched in an oblong frame between two rollers, being first wound upon the one and afterwards on the other, as the work is finished. The girl sits at the frame, with her left hand holding the thread below the cloth, the right hand, in which is the needle, resting on the frame above. The point of the needle is first thrust down through the cloth; and when the thread is caught on the hook, it is drawn up again with its back gently pressed to one side that the fan or hook may rise without interruption. When the first loop is thus formed, the point of the needle is moved a little forward in the direction of the pattern, where, the hook being still in the loop, it is again put down through the cloth, and another loop taken up through the former: and thus a chain is formed on the upper surface of the cloth similiar to one of the small ribs of a common stocking.

The process taught by Messrs Raphin and Habic differed somewhat from that now in practice. The tambourer had a kind of thimble made of sheet or white iron on the fore-finger of the right hand, with a slit in that part which projected beyond the finger for the needle to move in perpendicularly, while the handle of the needle was held between the thumb

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and middle-finger. In course of time, however, the thimble was thrown aside, probably from the difficulty of managing it at first; and the needle is now held nearly in the position of a writing-pen.

The thread in general use for tambouring white goods is made of cotton-yarn, and consists of two, and sometimes three ends laid together, and well twisted. Worsteds of every colour and shade are also wrought upon muslins in great abundance, by which the most beautiful and delicate flowers, festoons, &c. may be imitated with success. Silken and flaxen threads are also sometimes, though seldom, wrought in tambouring.

In the infancy of this branch of manufacture, the patterns to be wrought in tambouring were sketched on the cloth with a pencil; but when the increasing demand for these goods required greater dispatch, this tedious process was superseded by the present method of printing them with blocks. The blocks or prints employed for this purpose are made of wood, generally sycamore, well seasoned and dried, to prevent it from warping. The surface of the wood is planed smooth, and very level; and the pattern, which is previously sketched on paper, is traced on by means of the blunt point and coloured paper described under Draw-loom Patterns. The lines thus traced on the wood are left for making the impression, the intermediate spaces being scooped out with gouges and chissels of various sizes. Previous to this process, however, the print-cutter takes a sharp-pointed knife, fixed in a handle, and cuts the wood to a considerable depth on both sides of each line; and where there are buds, or other round objects, he cuts their round ends with gouges adapted to the size, excavating their centers with small drills. Considerable attention is requisite where the patterns are to join; to facilitate which, small pieces of wire are inserted at the angular points, which, by leaving marks on the cloth, give directions to the printer where the block is to be pitched. Patterns with large objects, such as all-overs, robes, &c. are usually cut out of one solid piece of wood; but sprigs, and other small detached figures, are generally sawed asunder, and glued on a piece of fir-deal at the requisite distances. In either case, a handle must be fixed on the back of the block for the printer to hold it by.

The cloth is printed on a large table, with its head a little sloped, after the manner of a writing-desk, and covered with a blanket or mat. A cushion, or sieve, for imparting the colour to the prints, is also necessary, which commonly consists of a square or oblong box, stuffed with dried elastic hair, over which is nailed a dressed sheep-skin, and this, again, is covered with a piece of fine cloth or cassimere. Some prefer a sieve floating on dissolved gum, similar to those employed by calico-printers; but the former kinds answer almost every purpose, and are much cheaper. The colour generally employed for printing grey muslins is indigo, or Prussian blue dissolved in water, and brought nearly to a boil. It is spread on the sieve with a brush; and when the face of the print is gently pressed on it, as much of the colour is usually taken on as makes two, and sometimes three impressions; for as uniformity of colour is of little importance in this species of printing, there is no necessity for recurring to the sieve at each impression. Goods which have been bleached, and only require washing after they are tamboured, may be printed with rose-pink dissolved in water, as it will come very easily off without leaving a stain behind. Pipe-clay and water will be found of advantage for printing-grounds which have been dyed dark colours.

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Among the various applications of power for abridging manual labour in the cotton manufacture, machinery for tambouring was likewise invented some years ago by Mr John Duncan, Glasgow, for which a patent was obtained. But so little progress has this ingenious invention since made, that although the term of the patent is nearly expired, and the patentees had constructed a considerable number of frames at a great expence, yet its application has never been extended beyond their own manufactory, where, at present, they have only one or two of them at work. Indeed, the great facility with which the market can be supplied with tamboured goods by the common manual process, and at very moderate prices, together with the limitation of pattern which must ever be attendant on the application of machinery, does not seem to hold out very flattering prospects to those who might be inclined to embark in this species of speculation.

Sewing.—The modes of ornamenting cloth with the common sewing needle are extremely various; but a minute description of all these processes would perhaps be as difficult as such details would be uninteresting to the general reader. Indeed, for the most part, they consist of a combination of those stitches which are usually taught to young ladies at school. There are, however, several of these species of ornament which, from their extensive application in the cotton manufacture, seem to merit particular notice.

The first of these that claims attention is satin stitch, which is the principal decoration of the finer kinds of muslins manufactured for robes, flounces, insertions, head-dresses, &c. The thread usually employed in sewing satin stitch is made of fine cotton yarn, seven or eight ends laid together, and very little twisted. Sometimes beat thread, or boss, is used for this purpose, which is composed of two threads of flaxen yarn, slightly twisted, and beat on a smooth stone with a wooden mallet, by which it acquires a glossy appearance, resembling silk. The patterns for sewing are, in general, printed on the cloth as for tambouring; and the leaves, buds, and other single objects are formed by making, first, a few stitches at their extremities, alternately leaving the thread loose between them for a kind of wadding. This wadding is afterwards covered with the thread, which is sewed over it at right angles, and always in one direction, forming a sort of relievo on the cloth, which has a very rich and prominent appearance.

Darning is another species of sewing employed in the ornamenting of cloth. It is effected by alternately dipping and raising the needle in its progress from one extremity of an object to the other, by which the threads are incorporated with the ground in a manner similar to some of the figures woven on mus-

Mountings. lins in India. This species of sewing, however, has not the solid, swelling appearance of satin stitch; but it has been frequently much in demand, probably from its striking resemblance of Indian manufacture. The workmanship on the borders and corners of the fine worsted shawls manufactured at Norwich is of this kind, and is perhaps the happiest imitation of Indian workmanship that we have in this country.

There is another kind of sewing called slabbing, which is very much wrought upon coarse, low priced goods. The process consists merely in making a stitch with the needle alternately, at the edges of an object, such as a leaf, bud, &c. leaving the thread floating loosely over its surface. Small detached patterns of this kind have been very successfully imitated in the loom by means of the lappet wheel; but robes and all other complex patterns must still be executed with the sewing needle. Besides these principal branches of ornament, there is a long list of subsidiary ones, such as veining, button stitch, seeding, roping, open stitch, &c. which are occasionally employed in conjunction with the former for the sake of variety, but of which it would be uninteresting to enter into a detail.

PART II. CONSTRUCTION AND APPLICATION OF THE PRINCIPAL APPARATUS OR MOUNTINGS EMPLOYED IN WEAVING.

When all the branches of weaving are traced to their first principle, it will soon be discovered that it is in separating the threads of warp to open a competent diversity of sheds for inserting the woof, that the art chiefly consists, and in this the ingenuity of the artist can be exercised with advantage. In the introductory part, we have taken a cursory view of the means by which this end is obtained in India, where these processes appear to depend much on dexterity and address, and where great labour and diligence are necessary to produce those exquisite fabrics and textures which are in such high estimation in this country. The mountings or machinery employed by European weavers, however, which we are now about to explain, are much better adapted to accelerate the progress of the operation, and, consequently to produce goods in much greater quantities, and at prices far below what those laborious operations can be supposed to afford.

In discussing this part of the subject, it was considered unnecessary to introduce the construction of the frame-work of looms, not only on account of their being universally known, but because it belongs to another branch of mechanics. There is one part of the loom, however, designated the lay or batten, which seems to merit some little attention. The lay is that frame which holds the reed, and with which the weaver strikes up his woof. As this frame is suspended on pivots above the loom, and its motion oscillatory, the artist may derive some important advantages, by applying to it the properties of the pendulum. In weaving very thin or light fabrics, for instance, the lay requires only to be kept in motion by the weavers hand, with a force barely sufficient to overcome the friction, &c., and therefore the quicker the weaver has occasion to draw the shuttle, the swords of the lay must be proportionally shortened by lowering the point of suspension. On the contrary, stout fabrics, which require the weaver's utmost exertion, must have the point of suspension raised, to increase the momentum of the stroke upon the woof. It is also of importance that the lay be so suspended, that the point called in mechanics the centre of percussion, should be found in that part of the reed which comes most frequently in contact with the cloth in striking up the woof. This point, in so complex a body as a weaver's lay, cannot be easily found by calculation, but it may be ascertained to a sufficient degree of accuracy for practical use by the following method: Suspend a lead bullet by a thread from the pivot of the lay, making both lay and bullet swing, then raise or lower the bullet until their vibrations be performed exactly in the same time, and the distance from the pivot to the centre of the bullet, measured on the lay from the pivot towards the reed, will give the centre of percussion sufficiently near for practical purposes; and when that part of the reed that strikes the cloth is in this part, the lay will have the greatest effect possible.

Chap. I. Of Mountings in general, and their Places of Draught and Cordage.

Sect. I. *Of the Heddles and Leaves.*

The most approved method of opening the sheds in weaving, and that which is almost universally adopted, is by means of heddles suitably arranged on shafts, and divided into leaves, or otherwise connected to the moving parts of the draw loom. Of the heddles, some are clasped, as represented in Fig. 1. Plate 45. and others are made with eyes, as in Fig. 2. In the heddle, Fig. 1. the warp thread passes through between the clasps in the centre, and as these heddles are chiefly used for plain fabrics, by catching the threads fast between the two loops, they prevent weak or soft yarn, in a considerable degree, from being unequally chained behind the mounting. Eyed heddles are principally employed in fancy mountings, to afford an easy passage for the warp when they are set back. These heddles, when made for light or flimsy fabrics, require only one knot or turn of the heddle twine to form the eye, as exhibited in Fig. 2; but for stout fabrics, such as diaper, or for the front heddles of damasks, which have considerably more stress to bear, two turns of the twine are usually taken, so as to cast a firm knot, to prevent the eye from slipping. Fig. 3. is the heddle used in the front mounting of the damask or other pressure harness, having an eye sufficiently long to allow the sheds to be fully formed by the harness, before they are again opened for the shuttle by the front leaves. Fig. 4. is the representation of a heddle, or harness twine, as adapted to the draw loom; it has the mail *a*, commonly made of copper, brass, or tin, in place of the clasp or eye of other heddles, and has likewise a small piece of lead

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b, attached to it below, to keep it duly stretched, and to sink it after being raised by the draw lay.

In mountings adapted to crossed warps, such as gauze or nets, when one thread is twisted round another, or crossed, perhaps, over one or more splitfuls of warp, it has been found expedient to add half heddles, called doups, which, by passing through a corresponding set of full heddles, or standards, they are allowed occasionally to traverse from side to side, by which these crossings are effected. Specimens of these heddles, for gauze, will be found at Fig. 5. and 6. where 1, and 2, point out the doups or half heddles, and C, D, the full heddles or standards. These standards are also sometimes clasped and sometimes made with eyes, as represented in the figures.

Fig. 7. is a view of the front heddles of what is called the false spider-net. The two doups 1 and 2, after passing through their respective standards, are united by a small lead or eye in the centre, and when the standard H is raised by one treadle, and G by another, the thread, *a a*, is drawn up alternately on each side of another thread, or rather splitful of warp, which passes through the same interval of the reed, and which is sunk to the bottom of the shed at each tread by other heddles behind.

Figs. 8. and 9. exhibit two different specimens of the front heddles for weaving a species of gauze called catgut. These have small glass beads in the bight or double of the half heddles, to prevent friction from the warp, and are therefore denominated beadlams.

Fig. 10. is a specimen of the doups and standards of a gauze-spot mounting. As certain portions of the warp are occasionally raised by these mountings to form the spotting sheds, the standard B is also raised to give it freedom, while the standard A keeps the doups fully stretched, and prevents them from getting entangled among themselves.

Fig. 11. is a front view of the standards and crossings of the beadlams of the whip-net mounting. This part of the mounting is placed before the reed to give the whip, which passes through the small glass-beads *a*, *a*, a greater range than is necessary in crossing the common gauze warp.

Fig. 12. exhibits the crossings of the beadlams of a very fine species of net, called the night-thought, or patent net; some further notice of which, as well as of the other mountings, will be taken in a future part of this article.

Heddles, in general, are formed and connected together, by taking the turn of a knot with the heddle twine round a piece of cord, called the *backing*, or *Maitland cord*, at the proper distances for the *sett* of reed to which they are adapted; but in fancy-mountings, where the succession of drawing in the warp is not uniform on the leaves, certain portions of the heddles are *cast* with intervening spaces, to adapt them to the intended pattern. In some kinds of stout mountings, however, the heddles for the figured parts are knotted individually on the shafts, so as to shift freely on the backing; by means of which they may be spaced to any pattern at pleasure.

Any portion of heddles which are stretched between two shafts, is denominated a *leaf*, or *shaft*; and the requisite number of leaves for producing any pattern, together with the apparatus for moving them, constitute a mounting.

Although patterns may be diversified and extended, by varying the succession of drawing the warp through the heddles, and changing the order of opening the sheds; yet, in general, the number of leaves in any mounting must be proportionate to the number of sheds or changes which it is intended to produce. To those who look but in a cursory way upon the art of weaving, it may appear somewhat surprising, that such a boundless variety of pattern can be effected, in all its branches, by comparatively a few leaves. But this surprise will in some measure abate, when it is considered that these changes increase with the number of leaves, in the same manner as those which are usually found by the rule of permutation in common arithmetic. Thus, for example, the changes which can be made with ten leaves, will be $1\times2\times3\times4\times5\times6\times7\times8\times9\times10=3.628,800$; and these with a draught only of one form. But if it be again recollected, that every change in the arrangement or succession of the draught will afford a new set of sheds, of equal extent, we shall soon find, that the variety which may be thus obtained is unlimited. It does not follow, however, that all these changes are actually of use in practice; but it is from this extensive power of a mounting that such sheds or changes are to be selected as will answer the intended purpose, and from which that endless diversity of pattern is derived that extends through every branch of fancy-weaving.

Sect. II. *Draughts and Cordings.*

The first consideration in fancy-weaving, is, to ascertain all the variety in one set of the pattern; and this is to be repeated as often as is necessary to make up the intended breadth of the web. When the pattern is to be woven with leaves, all this variety is marked upon a small plan of the leaves and treadles; and this scheme, which is equivalent to a ground or horizontal section of the mounting, is termed a *draught and cording;* or, in some manufacturing districts, a *draught and tie*, or *tie-up*.

Fig. 13. is an example of these plans, adapted to the common four-leafed tweel, and which corresponds with the leaves and treadles in Fig. 14. which is a front elevation of the same mounting. In this and other plans of the same kind, it is to be observed, that the spaces A, B, C, D, represent the leaves of heddles, and the figures 1, 2, 3, 4, at M, point out the order in which the warp-threads are drawn through the heddles of these leaves; that is, the first thread of warp is drawn through a heddle on the leaf A; the second, on the leaf B; the third, on the leaf C; and the fourth, on the leaf D, which makes once over the draught, or one set of the pattern. The same is to be observed in all other draughts which are marked in this manner. Sometimes the succession of the draught is marked by a small line or dash on each leaf, as at N; and in some cases, when the draught runs uniformly over the leaves, as in the example before us, it is pointed out by a straight line over the leaves, as at O; all these methods denoting the same thing.

Again, the spaces *a*, *b*, *c*, *d*, which cross the leaves at right angles, represent the treadles; and the cyphers in the squares formed by their intersections, in general, denote the raising cords, or shew what leaves are to be raised by each treadle; and as it is a general rule in weaving, though with a few exceptions, that all the leaves which are not raised by each treadle, must be sunk by it, the blank squares are sufficiently explicit to determine the sinking connections, and are always used for this purpose, unless particularly mentioned otherwise. By this example, therefore, it will appear, that two leaves are raised and two sunk by each treadle; and also, that the treadles are to be wrought over in the order of the figures 1, 2, 3, 4, marked on them, and which is the common method of pointing out the succession of treading.

As the treadles in this example, however, are placed in the regular or progressive order of the figures 1, 2, 3, 4, in order to exhibit the plan of cording to more advantage, the weaver, were he to adopt this arrangement in practice, would be obliged to cross his legs in a very awkward manner when he employed both feet upon the treadles. It is usual, therefore, wherever it can be conveniently done, to arrange the treadles in such a manner, as that all the odd numbers, retaining still the same cording on each, shall be placed together for one foot, and all the even ones for the other; by which arrangement the treading becomes alternate without any obstruction. The treadles, therefore, of the present example, would stand thus, 4, 2, 3, 1; and the weaver would press down the treadle 1 with his right foot, 2 with his left, 3 with his right, and 4 with his left; and so in other instances of the same kind.

The preceding observations on draughts and cordings are general, and apply to almost every species of weaving, where the warp is raised and sunk by the perpendicular motion of the heddles; but when the warp-threads are twisted or crossed over each other by the peculiar construction of the mounting, some farther consideration becomes necessary. The mounttings for cross-weaving, in general, consist of two parts, which are distinguished by the appellation of back and front-leaves. The doups and standards, formerly explained, constitute the front part; and two or more common plain leaves are usually placed behind. The back-leaves form what is termed the open shed; in which state, the warp being parallel, and the doups or beadlams slack, and crossed over the intervening threads, the warp may be raised and sunk by the back-leaves, without being in the least affected by these half-heddles. In the cross-shed, however, the warp-threads are drawn from their parallel state by the doups or beadlams, which are now close to their standards; and when the standards are raised and sunk, these threads are also raised and sunk to a certain distance from their position in the former case. When the crossing is confined to one interval of the reed, which takes place in the several varieties of gauze and catgut, the heddles are all placed behind the lay or frame that holds the reed, in the usual way; but when the crossing extends over one or more splits, the doups and standards are placed before the reed, and the warp is drawn through the small glass-beads formerly noticed, in order to take off the friction that would arise from moving the heddles backward and forward with the lay. This last species of weaving is known by the appellation of nets, of which there are several very beautiful varieties, and which will be treated of in their proper place.

This much premised, we shall now proceed to explain the plan in Fig. 15. which is the draught and cording of a plain gauze; and will serve, for the present, to illustrate the principles of cross-weaving in general. In this plan there are only two back-leaves, A and B, which are sufficient for a plain gauze. The first thread, *i*, of the two which pass through the same interval of the reed, is drawn below the clasp of a heddle on the leaf A, and the other thread, *a*, above the clasp of a heddle on the leaf B; both of these leaves producing only one shed, which is all that is required in the present instance. C and D are the two standards in the front part, and 1, 2, the two doups or half-leaves, corresponding with the same figures and letters of reference in Figs. 5 and 6. Again, the thread *i* is drawn through the upper doup 1, as represented by the dot in Fig. 5.; and the thread *a* passing below the other, is drawn through the under doup 2, in the same manner; and as two threads, or one splitful, in this case, are equivalent to one set of the draught, the whole of the drawing is merely a repetition of this process.

On the open treadle, marked *o*, Fig. 15. there is a dot, instead of the cypher in the former example, which denotes a raising cord for the leaf B, and a cross, ×, for a sinking cord, on the leaf A; as this is an exception to the general rule above mentioned, this distinction becomes necessary. Again, there is a dot or raising mark on the standard C, and a cross or sinking mark on the standard D, and these produce the open shed. On the cross treadle, which is marked *c*, there is a raising mark on the standard D, and a sinking one on C, the back leaves at this tread being stationary. The treadle, *p*, merely reverses the cross shed, when plain cloth is required. The manner in which the connections are formed to open these sheds, will be explained in the following chapter.

Chap. II. Of the different Methods of Mounting the Leaves or Heddle-shafts.

Sect. I. *Of mounting with Pulleys and Jacks.*

Having explained, in the preceding chapter, the different kinds of heddles which are in common use, and the plans by which the weaver is directed in drawing the warp through them, we proceed now to shew, in a variety of instances, the means by which these heddles are put in motion to open the requisite diversity of sheds.

The most simple method of mounting a loom, with which we are acquainted, is with what the weavers term stocks and pulleys. For the plain texture, which requires only two leaves of heddles, a pulley, fixed in a small block, is suspended at a convenient distance from each side of the web, from a piece of wood laid across the loom above, called the heddle-bearer, and the upper shafts of the two leaves are connected together by cords passing over these pulleys.

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Each under shaft is connected by cords below, to a piece of wood called a spring-staff, and these spring staves are again connected to the treadles. When, therefore, either of the treadles is pressed down, it sinks the leaf to which it is connected by the intermediate spring staff, and the other leaf is raised by the cords passing over the pulleys.

In applying stocks and pulleys to fancy weaving, it may be observed that when the number of leaves is even, and one-half raised and sunk by each tread, webs may be mounted on this principle to any practicable extent. But when the number of leaves is odd, or unequal numbers raised and sunk by each treadle, the stocks and pulleys cannot be employed with much advantage. They are sometimes adopted, however, in mounting three, five, or other odd-leafed tweels, in the coarser kinds of weaving, with the addition of a moveable pulley. But as the fixed and moveable pulleys do not afford an equal range to the shafts, this method does not appear to be well adapted to fine work.

As this method of mounting, however, is very steady, and seems to be well adapted to power looms, we shall insert two examples, to shew its application to tweeling.

Plan of a Four-leafed Tweel.

	0	0		A 1 1 A
0	0			: B 2 2 : B
0			0	A : 3 3 A :
		0	0	B 4 4 B
1	2	3	4	

In this plan, which is the same as Fig. 13. the two leaves marked A . . A, are connected together by a cord passing over one pulley at each side of the web, and the leaves B, B, are connected over another pulley in the same stock, and generally on the same axis, though sometimes the one pulley is placed above the other.

Plan for a Tweeled Damboard.

								A	B
0				0	0	0		4 1	1 1 1
	0			0	0		0	3· 2	2 2 2
		0		0		0	0	2·· &c.	3 3 3
			0		0	0	0	1···	4 4 4
0	0	0		0				1··· 1 1 1	
0	0		0		0			2·· 2 2 2	
0		0	0		0			3· 3 3 3	
	0	0	0				0	4 4 4 4	
1	2	3	4	1	2	3	4		

In the plan for the damboard, the succession of the draught is marked at B, one portion being drawn on the four back leaves, and another in the four front ones alternately, and these portions are greater or smaller, according to the size of the squares which constitute the pattern. The stock for this pattern contains four pulleys either moving in the same axis, or one raised above another; and supposing these pulleys to be numbered 1, 2, 3, 4, the two leaves marked 1, 1, at A, are connected by a cord passing over the first pulley; the leaves 2, 2, over the second, the leaves 3, 3, over the third, and the leaves 4, 4, over the fourth. The same takes place at the other side of the web. As there are no raising cords employed in the method of mounting, the cyphers, or blank squares, may represent the cords which connect the spring-staff to the treadles at pleasure. See the article Tweeling.

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The next method of mounting a loom, in point of simplicity, is with jacks; although, like the pulleys, they are not well adapted to fancy weaving. Jacks are, however, much used in weaving the lighter kinds of plain goods, and in some of the smaller tweel mountings.

The jack is a small equal armed lever, which is suspended above the heddle-shafts by its centre, one end or arm being connected to one leaf, and the other to another; so that, when either of these leaves is sunk by a treadle below, the other is raised by the opposite end of the jack, similar to the method by the pulleys. Hence it is evident, that all the connections necessary for a plain fabric, may be formed with one jack at each side of the web; but as these connections take place at a considerable distance from the centre of motion, the leaves would not rise and sink so equally as by the fixed pulleys; and, therefore, it is common to mount two jacks on each side of a plain web, and four on the four-leafed levers, &c. which move in contrary directions when the sheds are opened. The connections below are the same as in the stocks and pulleys, and in both cases, when the web is broad, and even in some narrow ones, the treadles are connected to short marches, which are again tied to the spring-staves.

When the heddles of these mountings are made with eyes, they are easily shifted back when required, by the lay or weaver's hand; but when they are clasped, the end or shafts must be raised by the hand, in order to relieve the warp when this operation takes place, or else some other apparatus must be applied for this purpose. The most simple, perhaps, of these methods is, to introduce a small rod below the clasps of the heddles of each leaf, and which rests on the under shafts. When these rods are raised to the clasps by cords from their ends, and passing over a pulley, either to the hand or to a long march and treadle appropriated to that use, the clasps are opened in such a manner as to permit the warp to pass through them without obstruction.

Jacks, like the stocks and pulleys, are best adapted to mountings in which an equal number of leaves are raised and sunk by each treadle. When jacks and pulleys, however, are combined in a suitable manner, they may be made subservient to different branches of fancy weaving, and afford facilities which are at present overlooked. In the four-leafed tweel, for example, two leaves must always be raised and two sunk by each treadle, when woven by any of the preceding methods; but if two jacks be connected by their centres, by a cord passing over a fixed pulley, and the four ends of these jacks again connected respectively to the four leaves of the tweel, either one, two, or three of these leaves may be raised by each treadle, while the others are sunk at the same time.

But the most general method of mounting fancy looms is that with coupers and marches, a method that is applicable to any number of leaves, without exception, that can be practically employed.

Sect. II. *Of mounting with Coupers or Marches.*

The apparatus which we are about to explain consists of an assemblage of levers, variously applied; some for increasing the power, and others merely for changing its direction. Fig. 14. is a general view of one of these mountings, which, as formerly noticed, is adapted to the four-leafed tweel. The coupers B are levers of the first order, having the fulcrum or prop between the weight and power. The fulcrum or bolt on which they turn as a centre, is usually about one-third, or two-fifths of the length of the couper from the weight, or that point where they are connected to the heddles, and, consequently, a corresponding increase of power is obtained. The long marches D, are levers of the third order, the power acting between the prop and the weight, and these marches or levers are employed with a diminution of power to change its direction, or to raise those levers with which they are connected, by a downward pressure of the foot. The short marches E, are levers of the second or third order, according as the sinking cords, *c*, are tied on the right or left of the cords *b*. The object of the short marches, however, is neither to increase nor diminish the power, but for the convenience of connecting a number of treadles to any one leaf. The treadles, whose ends only appear at 1, 2, 3, 4, have their centre of motion commonly behind the weaver or below his seat; in which position they are levers of the third order, and, consequently, the weaver loses power in proportion as he places his feet farther from the raising and sinking cords. In heavy mounted work, however, it is common to reverse the position of the treadles, placing the centre of motion below the warp beam, and working on their opposite ends, by which the weaver considerably increases the power, though his tread will be deeper in proportion. These observations premised, we shall now endeavour to explain the manner in which webs in general are mounted on this principle. The coupers B, are placed in a horizontal position in the frame or top-castle A, and are retained in that position during the time of mounting, by a small frame called justers, which is placed between them and the top-castle, and in which they are secured from moving by cords. This done, the end of each couper, which is over the centre of the web, is connected to its respective leaf by the *bow-cords a, a*, as represented in the figure. The connections between the coupers and long marches, are formed by the *side cords c*; and each of the short marches E, is tied to its respective leaf by the cord *b*.

Thus far the process of mounting any web on this principle is invariably the same, and may be considered as permanent: for all the changes and diversity of which the mounting is susceptible, exclusive of the succession of the draught, are effected by the tying up, and order of working over the treadles. The arrangement of the raising and sinking cords for any pattern, as formerly observed, is previously marked on the plan of cording; and with this guide before him, the weaver is able to tie up the most intricate pattern that may occur. In the example before us, Fig. 13. there are raising marks on the treadle 1, where it crosses the two leaves C and D; and, consequently, the long marches of these two leaves must be tied to this treadle. But as there are no marks on the squares when the leaves A and B cross it, sinking cords, as formerly mentioned, are understood; and, therefore, this treadle is connected, directly, to these leaves by cords from their short marches. In the same manner, the long marches of the leaves B and C, and the short marches of A and D, are all tied to the treadle 2; and so on with the remaining two treadles.

In mountings adapted to cross-weaving, the same general rule is to be observed in connecting the marches and coupers with the leaves. The doup or half-leaf 1, Fig. 15. is placed behind the upper part of the back standard C; and the half-leaf 2, is placed before the under part of the front standard D; each half-heddle passing through its respective standard, as represented in Figs. 5. and 6. Now, as there are only the three upper shafts, 1, C, D, Fig. 15. in the fore part of a gauze mounting, the shaft 2 being an under one, these three shafts, together with the two shafts A, B, of the back leaves, are all connected to their respective coupers above; and the shafts of the half-leaf 2, with the under shafts of the two standards and back leaves, are connected to the five short marches below, respectively; the coupers and long marches being connected by the side cords, as in the preceding mounting. These connections will appear in Fig. 16. which is an elevation of the front part of a gauze or net mounting. The dots and crosses which are placed on the intersections of the leaves and treadles, Fig. 15. shews, that these treadles are to be connected to the long and short marches of these shafts respectively; that is, the treadle *o*, is tied to the short march of the leaf A, and to the long march of the leaf B; and again, the same treadle is connected to the long march of the standard C, and short march of the standard D. In like manner, the short march of the standard C, and long march of the standard D, are tied to the cross treadle *c*. There are no connections between these treadles and the two half leaves; for, in the former case, the doups or beadlams being relieved from their standards, are acted upon entirely by the shed formed by the back heddles; and in the latter case, they are drawn tight to their standards, and, consequently, are raised and sunk along with them. The plain treadle *p*, is tied to the long march of the half-leaf 2, and short march of the half-leaf 1; and as the former of these is raised and the latter sunk by this treadle, they communicate the same motion to their respective standards. But as there are no connections between the half-leaves and the open and cross treadles, the doups or beadlams are kept tight to their respective standards in the cross shed, and relieved from them in the open one, by small weights suspended from the first and third short marches, resting occasionally on the first and third long marches, in the manner following: A piece of twine is tied round the first short march at *u*, Fig. 16. and descends to the first long march at *i*, where it is tied to a small piece of wood,

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sometimes a bit cut off a bobbin or spool, and which is equal in length to the thickness of the march. The cord *g*, which is taken through a hole in the piece of wood, descends on each side of the march to another piece of the same kind, which is applied to keep them separate; and to this last piece the weight *w* is appended. In the very same manner the weight *x* is suspended from the third short and long marches.

The back and front mountings of a gauze should stand about two, or two and a half inches separate, that the cross shed may be freely formed without straining the warp. Particular attention is also necessary in adjusting the weights; for, should they be too light, the doups would remain somewhat slack, and project from their standards in the cross shed, and produce a considerable degree of attrition, which is known among the workmen by the name of *crunching;* and were they too heavy, they would draw the doups back through their standards and strain the warp. Should the *crunching* continue after the web may be considered partly mounted, it will often be removed by shifting the cord which connects the under fore shaft to the first short march, a little to one side. There is no rule for determining the precise weight which is to be applied to each half-leaf; for this will, in general, depend on the quantity of warp in the web, and the distance at which the weights are suspended from the centre of motion.

Although these observations are chiefly confined to the plain gauze, yet they are equally applicable to the several varieties of cross-weaving in general. Fig. 12. for example, is that part of the mounting of the patent net or night-thought, that is placed before the reed. In this Fig. the leaves C and D, and the half-leaves 1 and 2, correspond with the standards and doups of the gauze mounting. And although they are, in weaving nets, attached to the lay, and move backward and forward along with it, yet, in every other respect, they are mounted in the same manner.

In this net, however, there are two sets of gauze mounting; one for the ground, which is the common gauze, and the other for the whip or net part. Sections of the gauze threads, when the open shed is formed, are seen at *a* and *b*, and the beads through which the whip or net threads are drawn appear at *x* and *z*, the beadlams being also in their slack or open state. Now, if we suppose the two threads that pass through the beads *x* to be drawn on a back leaf directly behind where they stand at present, and the two threads which pass through the beads *z*, to be drawn on another in the same manner; then it will be evident, that, when the former of these leaves is raised and the latter sunk, the beadlams at the same time being slack, the beads connected with both leaves will assume the position in which they are represented in the Fig.; that is, the upper beadlam whip will be sunk below the shuttle, and the under beadlam whip raised above it, by which the shed is formed. But in the cross shed, the whip being slackened by an apparatus applied to the whip roll for this purpose, the beads *x* are drawn close to their standards at *y*, and the beads *z* to their standards at *w*; and, consequently, the threads of whip will be drawn across the intervening spaces, and formed into another shed at the other extremity of this range. And hence it will appear, that the whip, although it takes a greater range in this example, is crossed on the very same principle as the gauze warps. But as this article is appropriated only to the explanation of the apparatus employed in fancy weaving, and not to the fabrication of cloth, the several varieties of gauzes and nets will be discussed under their proper heads.

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Sect. III. *Of Diaper Mountings.*

It is a pretty general rule in weaving with leaves, as formerly observed, that when any treadle raises a certain portion of the warp to form a shed, it sinks all the rest down to the race-rod at the same time. This and the method of mounting webs, however, among some others, form exceptions to this rule. In these methods, the eyes of the heddles are placed so low, that when the lay is put back to the requisite position for throwing the shuttle, all the warp lies close to the race-rod, and the sheds are formed merely by raising one or more of the leaves by each treadle; and these are sunk again by weights appended to their under shafts.

In the single diaper mounting, which is chiefly employed for weaving a kind of small flushed figures on stout fabrics, called bird-eye patterns, there are two sets of coupers or top-levers, one set being placed a little higher in the frame than the other, with the longer ends of each set turned out towards the selvage of the web. The long arm of each couper is connected to its respective leaf by a cord, descending perpendicularly to its upper shafts, at the usual distance from the selvage, and the other ends meet above the centre of the loom, when the two coupers of each leaf are connected together by another perpendicular cord. From the short end of each of the lower set of coupers, a cord or wire descends through the centre of the warp to the short march or spring-staff to which it is fastened; and the treadles are connected to the march of such leaves only as rise in the formation of the sheds.

The double diaper mounting is, at present, exclusively confined to the weaving of damask and diaper. It is employed for diaper patterns that require from three to seven sets of a five-leafed tweel. But so many treadles as these larger patterns would require, if mounted in the manner described in the last section, would be found too heavy for a man to work for any length of time, and to occupy so much space as to render it very incommodious to stretch his feet over. These inconveniences, therefore, are partly obviated in this method of mounting, by placing the greater part of the apparatus above the loom, reserving only so many treadles below as work one set of the tweel.

Plate 45. Fig. 17. is a back view of this mounting, as adapted to a diaper pattern of four divisions, or four sets of tweeling leaves, five in each set. A is the top frame or heddle-beam; B is one set of coupers, which are connected respectively to their leaves by the cords *p*; C is another set of coupers, also equal to the number of leaves to which they are respectively connected at the opposite side by the

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cords g; and every couper in the set B is again connected to a corresponding couper in the set C, by the cords d. At 1, 2, 3, 4, 5, are represented the ends of a set of treadles, five in number, or one for each leaf in the tweel, whose centre of motion is back over the weaver's head at m, Fig. 18. From these five treadles, the five cords 1, 2, 3, 4, 5, descend through the warp, passing through the small board n, and are fastened to the treadles v, w, x, y, z, respectively. The board n is tied to the sides of the loom by the cords t, and serves to keep the cords 1, 2, 3, &c. perpendicular when the loom is at work. s s are weights appended to the under shafts of the leaves, which sink them after being raised to form a shed.

The various sheds of this mounting are opened by the connections which are formed between the set of coupers C, and the top-levers 1, 2, 3, 4, 5. These coupers are again divided into four inferior sets, or compartments, five in each, and corresponding with the four sets of the tweel, as represented in the following plans: No. 1. is the plan of cording for a four-leafed tweel, or dornick; and No. 2. is that of a five-leafed tweel for diaper.

No. 1.

	0	0	×		0	0	×		0	0	×		0	0	×
0		×	0	0		×	0	0		×	0	0		×	0
0	×		0	0	×		0	0	×		0	0	×		0
×	0	0		×	0	0		×	0	0		×	0	0	

No. 2.

			C					C.					C.					C.		
1	0		0	×	0	0		0	×	0	0		0	×	0	0		0	×	0
2	×	0	0	0		×	0	0	0		×	0	0	0		×	0	0	0	
3	0	0	×	0	0	0	o	×	0	0	0	0	×	0	0	0	0	×	0	0
4		0	0	0	×		0	0	0	×		0	0	0	×		0	0	0	×
5	0	×	0		0	0	×	0		0	0	×	0		0	0	×	0		0

In these plans the marks × represent cords which are tied tight between the coupers C and levers 1, 2, 3, 4, 5, Fig. 17.; and the cyphers signify slack cords connected in the same manner, but which are occasionally drawn tight by pulling the bobs or handles 1, 2, 3, 4, in Fig. 18; and the blank squares shew when neither slack nor tight cords are necessary. These connections will be seen at a, b, c, d, Fig. 18, where c, c, c, c, represent the ends of the coupers C in Fig. 17. and which are also represented by the cross spaces on the preceding plan, No. 2. In this plan, likewise, the long spaces 1, 2, 3, 4, 5, represent the levers D in Fig. 18. or 1, 2, 3, 4, 5, in Fig. 17.

Now, if we suppose a cord to be tied tight from one couper in each set to the lever 1; when this lever is pulled down by the treadle v, it is evident that one leaf in each set will be raised, and thereby open one shed of the tweel across the whole web, the other coupers not being affected by this lever on account of the slack cords. In like manner, if the next couper in each set be connected by a tight cord to the lever 2, the treadle w, below, will raise another leaf in each of the four sets; and so with the remaining three levers, 3, 4, 5; none of the warp being sunk in forming these sheds as mentioned before.

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Hence, when these connections take place, agreeably to cording the plan of any particular tweel, as, for example, that of the cross marks × in No. 2. by working straight over the treadles v, w, x, y, z, the leaves will all be raised in the same succession; and the whole web will thus be converted into a five-leafed satin tweel, one thread of each five being raised above the shuttle.

But, in order to turn or reverse the tweel, by which the pattern is thrown up in this branch of weaving, other three of the five coupers in each set are connected to the levers 1, 2, 3, 4, 5, Fig. 17, by the slack cords above-mentioned, which are tied to the smaller rings or loops at r; and another cord passes from this ring down through the lever, as at a, b, c, and d, Fig. 18. and runs along the under side of it to the box e, f, where it again passes round a small stick which serves instead of a pulley, and is fastened to another short march i. A view of the box, as seen from above, will be found at P.

Each of the four marches i, therefore, has five cords tied to it; one from each of the levers 1, 2, 3, 4, 5; and these are all made tight at once by raising the end of the couper n; for example, by the bob or handle 4, which is secured in a notch cut in the board R, while the weaver works over the treadles below.

Hence it follows, that when all the cords in each set are drawn tight, which would be effected by pulling down all the bobs at once, there would be four tight cords from each set of coupers to each of the levers 1, 2, 3, 4, 5; and consequently, by working now over the treadles v, w, &c. Fig. 17. four leaves out of five would be raised in each set; and as there is still one couper in each set that has no connection with the levers 1, 2, 3, 4, 5, as pointed out by the blank squares in the plan of cording No 2. the leaves connected to these coupers can never rise; and therefore the whole of the cloth would again be woven a satin tweel, but reversed; that is, the flushing by the weft would be thrown to the contrary side of the cloth from that in the former case.

It will now be obvious, that by pulling any one or more of these handles, any one or more of the sets of leaves may be raised to turn the tweel, by which all that diversity of pattern may be produced that we find in diaper weaving. For an explanation of dornick and diaper weaving, see Chap II. Part III.

It is also to be observed, that in No. 2. the tight cord, or ×, falls on the centre of the middle treadle of each set when the blank space should also have occurred; this cord, therefore, must be so fastened that the weaver may use it as a tight or slack cord at pleasure.

Sect. IV. *Of the Saw, Barrel, and other Substitutes for Treadles.*

The reader by this time will readily perceive, that when a web is mounted with its full complement of treadles, there must be one for each separate or distinct shed; and therefore, when the sheds of any

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The most simple and natural method of raising the leaves without treadles that probably would occur to the fancy-weaver, is by means of a boy or girl, seated at the side of the loom, and pulling certain cords as the weaver had occasion for the sheds. In this method, the ends of the coupers of such leaves as are to be raised to open any shed, are all connected to one cord at the side of the loom, which descends towards the floor like the side-cords in the other mountings; and which, after passing through a hole in a small horizontal board fixed for this purpose, is kept stretched by a weight appended to the lower end. A cord of this description must be connected to the coupers of those leaves respectively which are to open each shed; and, by descending through the hole-board in regular succession, or in the order in which the sheds are to be formed, the draw-boy has only to pull these cords progressively along the boards as they occur, which he can perform with as much facility and dispatch as the weaver can throw the shuttle.

This method was practised till of late in weaving diaper, and is still adopted in some other kinds of high-mounted looms; and that as many leaves may be comprised in a small space as can be conveniently employed in these cases, they are commonly divided into certain portions or sets, the heddles of each set being made of a different length from the others, so that their shafts may stand one tier above another, at a distance sufficient to keep clear of each other when the sheds are opened. Thus, in a web mounted with ninety leaves, which is frequently the case, if the shafts are made about 1-8th of an inch thick and pretty deep, thirty of them, which, suppose, form the first set or tier, may stand in the space of four inches. The heddles of the second set, or thirty leaves, must now be made considerably deeper, so that their shafts may rise and sink without coming in contact with the former; and therefore, as these heddles are placed among the leaves of the first set, they will occupy little more room than is allotted to the first tier of shafts. In like manner, the third set, or thirty leaves, are made so much deeper still than the second, that their shafts may keep perfectly clear of all the others; and, consequently, the whole ninety leaves, by this arrangement, may be comprised in little more space than is occupied by the first thirty.

The preceding method of disposing, in a straight line, the side cords for the several lifts in the pattern, by which they require only a perpendicular motion of the hand to open any shed, and a small horizontal range from one cord to another, would naturally suggest the expedient of applying machinery as a substitute for the draw-boy.

If, therefore, a knot were made, or a large bead fixed on each of these side cords, a little below the hole-board that regulates their distances, and a fork or catch were applied so as to take hold of these knots or beads in regular succession, when pulled down by a treadle mounted for that purpose, while, by some other contrivance, the catch were shifted from one knot-cord to another after each lift, the machinery here proposed would be constructed.

Machines on this principle have been made in great variety; in some the knot or bead-cords are arranged in straight lines; in others round the circumference of a circle, with the catch turning on an axis in the centre. The catch was formerly made to move in a perpendicular direction; at present, it is in general so constructed, as to describe an arc of a circle, in which form it is usually called the cock or parrot.

In either of these cases, the motion is communicated to the catch or parrot by means of a treadle and long march. The treadle may be the same that sinks the catch, provided there be not another more suitable; for, while it is pressed down to open any shed by the parrot, a cord from the long march running over a pulley, or connected to the end of a jack or couper, so as to change the direction of the power, will raise the hammer or other device connected to the other end, which, sinking again by weights appended to it, as the weaver takes his foot off the treadle, will move the saw or wheel connected with the parrot a certain space, which will be proportionate to the distance of one knot-cord from another.

A view of one of these machines, on the most approved principle in present use, will be found in Fig. 1. Plate 46. A A is a frame that stands at the side of the loom, opposite to the ends of the heddle shafts. B B are small hole-boards in which the knot-cords are arranged in a straight line. *a* is the catch or parrot that pulls down the knot-cords, a side view of which will be found in Fig. 2. D is a wheel that turns the parrot, and is fixed on the same axis E. This is effected by means of a cord or band passing over the upper part of its circumference, and connected to the long march and treadle that work the machine. F is a wheel for giving the horizontal range to the parrot *a*. Its circumference is divided into a certain number of teeth, like those of a ratchet wheel, and which is commonly equal to the greatest number of lifts or pulls for which the machine is constructed. On the inner side of this wheel, at *o*, is a groove cut in a projecting part, of less diameter than the ratchet, round which the cord *p* is wound when the wheel is turned by the treadle. This cord is first tied to the weight *w*, and, passing over the pulley *y*, it is fastened to the parrot *a*; after which it passes through a hole in the wheel D, as at *x*, Fig. 3.; and running over another pulley at *i*, it is fastened in the groove of the wheel F. *g* is a small wheel on the same axis with F, for disengaging the catch from the teeth of the ratchet. P is the hammer which turns the wheel F, by means of a wire *z*, working in its teeth, as it sinks by the weight *n*.

In Fig. 2. *b b*, are the ends of the two hole-boards, on the same side of the machine, one above the knots and the other below, to keep the cords perpendicular, and opposite to the parrot. *c* is the knot, or much oftener a large bead, which the parrot catches in its descent. *d* is a square hole through which the axis E, Fig. 1. passes, and on which it must be allowed to move freely. *e* is another hole, with a wire across, to which the cord *p* is fastened. *w* is a weight appended to the knot cord, by which it is kept duly stretched. Fig. 3. is a side-view of the wheel D, having the square axle fixed in its centre, and the cord *p* passing through the hole *x*.

Fig. 4. is a view of the ratchet wheel F, in Fig. 1. *g* is the small wheel at *g*, Fig. 1. but moveable on the axis E. When the point *m* of the hand or index is turned round by the stud *n*, on the ratchet, to the position *u*, it lifts the catch out of the teeth of the wheel, and keeps it disengaged while the weight at the opposite end of the machine pulls the wheel round the contrary way, until another stud *s* comes round and drives it back; by which the catch *x* is again inserted in the teeth, and the machine ready to begin the pattern anew. The studs *s* and *n* may be placed at any distance round the wheel, so that the number of teeth between them may be equal to the number of lifts or pulls in one set of the pattern. The hammer P works in the teeth of the ratchet wheel at *y*. The cord P passing over the pulley *h*, is connected to the end of a long march, which being sunk by a treadle, raises the hammer; and as the weaver takes his foot off the treadle, the weight *u* sinks it with a force sufficient to turn the wheel one tooth by means of the wire *z*; and thereby the parrot is shifted from one knot-cord to another.

M is a piece of hard wood, cut in form of a saw, which is sometimes substituted for the cord *p*. This saw is so mounted as to move only the distance of one tooth, when it returns again to its former position. At each of these moves it catches the wire in the hole *e*, Fig. 2. and shifts the parrot from one knot-cord to another. It may be farther observed, that in order to increase the power, or rather range of this machine, a row of knot-cords is usually placed on each side; and the parrot first draws a cord at one side, and then at the other, in each position.

But the state of the machine, it will be observed, is only adapted to raise such leaves as are required to form the sheds, without sinking the others. As this, however, is necessary in most branches of weaving, it is easily effected, by taking another cord from the couper of each leaf, down nearly to the floor, where they are tied, separately, to the end of a lever, resembling a treadle, keeping them all parallel and equidistant. The other end of the lever extends backward, behind the loom, where it moves on its centre. To the under shafts of those leaves that are wrought with the machine, an appended weight sufficient to sink them when at liberty to descend, and the lever to which these side cords are tied, must also be loaded with weights, in order to balance both the leaves and weights attached to them. This lever is connected to the march, and consequently to the treadle that turns the parrot, by a cord passing over a pulley a little above them; and, therefore, when this treadle is pressed down, all those leaves which are not raised by the parrot, being relieved by raising the end of the lever, are sunk with their warp to the bottom of the shed by the weights appended.

Another principle on which machines for raising leaves are constructed, is, instead of arranging the lifts in straight lines, to insert them round the circumference of a cylinder, similar to the barrel of an organ; whence these machines have been denominated barrels.

In mounting the most common of these machines, a knot-cord from the couper of each leaf descends by the side of the loom, in every respect like the side-cords of a common mounting; but instead of tying their lower ends to the long marches, they are fastened to a lever below, as in the preceding machine. The knot-cords are all parallel to each other, and pass through a small hole-board, as in the former case, to keep them at their stated distances. The barrel is fixed on pivots, and set in a horizontal position close to the knot-cords, and is moved by an apparatus similar to that of the parrot. To one end of the barrel is screwed a ratchet wheel, the teeth of which regulate the extent of the pattern. From each tooth of this wheel a line is drawn from one end of the barrel to the other; and exactly opposite to each knot-cord a circle is described round its circumference; so that, on the intersections of these lines, agreeably to the design of any pattern, are inserted a kind of forked studs, which, as the barrel turns round, push in, between the teeth of a comb, such of the knot-cords as are to raise the leaves for any particular shed.

The comb here mentioned is generally a piece of hard wood, sometimes a part of an old oak barrel stave, broad at one end, and tapering towards the other. The broad end is indented, by the cut of a saw, opposite to each knot-cord; and to the small end is suspended a weight. Near the middle of the comb are pivots on which it turns as on a centre; and a cord from the broad end, tied to a long march, sinks it with any of the knot-cords that may be between its teeth, as the weaver has occasion for a shed; the weight at the narrow end restoring it to its former position when the treadle is relieved. When two or more adjacent knot-cords are to be sunk for one shed, a piece of wire, bended in form of a staple, and driven into the barrels, will answer much better than a separate stud for each leaf.

It would be endless, however, to attempt an enumeration of the various ways in which these machines are mounted; for when the principles on which they operate are once thoroughly understood, every tradesman will adopt such a method as will best please himself.

Sect. V. *The Back-harness.*

In the foregoing methods of mounting webs, every individual thread is supposed to have its own heddle through which it is drawn; and therefore the sheds are formed directly by raising and sinking the leaves.

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But in various branches of fancy weaving, it is found a very convenient contraction of the mounting, to draw a number of threads into one heddle or mail; and, by raising certain portions of these mails above the shuttle, to open the sheds afterwards by another set of leaves in front. This method of opening sheds is chiefly adopted in weaving fanciful patterns on tweeled grounds, or which are formed by tweeling, and is the principle on which the mounting we are about to explain is constructed.

The back-harness consists of a number of back leaves, one for each division or set of the tweel requisite for the pattern, and generally made with mails instead of eyes, through each of which a number of threads is drawn, equal sometimes to the number of threads in one set of the tweel, though this is discretionary; so that four harness leaves, for example, with five threads in each mail, and a set of front leaves, five in number, will produce the same effect as the twenty leaves in the double diaper mounting formerly explained. The front leaves have their eyes a little longer than the depth of the sheds formed by the back-harness; and on these leaves all the warp is again drawn in single threads, and in the same regular succession as any other tweel.

There are several methods of mounting the back-harness. Fig. 5. Pl. 46. is a profile view of one of these methods, and will serve to explain the principle of this apparatus in general. The numbers 1, 2, 3, 4, point out the harness-leaves; *a, b, c, d, e,* the front leaves, with the eyes of their heddles sufficiently long to allow the warp to rise by the mails. Fig. 6. shews the manner in which the warp of each mail is again drawn through the front-heddles. Each of the black spaces on the leaves 1, 2, 3, 4, represents a mail or heddle on the back leaves, Fig. 5. and is here supposed to contain five threads. These threads are again drawn separately on the front leaves in the succession *a, b, c, d, e.* The cyphers on the treadle plan point out the raising cords for these leaves, and the cross marks the sinking ones. Now, it will be apparent, that when any one or more of these harness leaves are raised, as at 1, all the warp in their mails will also be raised above the shuttle; and by sinking one of the front leaves, as at *e*, one of the five threads in each mail will be taken back to the race-rod; and when another of the front leaves is raised, as at *a*, it will take up one of the five threads of each mail that remained sunk; and thus the various sheds are formed for weaving diaper patterns. The harness-leaves are raised by the bobs 5, 6, 7, 8, and the knots on the cords are placed in notches formed in the board R, while the weaver works over his front leaves as in the double diaper mounting.

Mountings of this description are employed for weaving diaper patterns that require to the extent of thirty back leaves, which, together with the five in front, make in all thirty-five. Now, the same range of pattern, if woven in the double diaper loom, would require five times 30, or 150 leaves; which shews the great superiority of this simple apparatus over any other of equal extent. Patterns of still greater range, however, might be woven by this mounting, if one tier of shafts were raised above another, as formerly explained; but when these patterns exceed the bounds of thirty leaves, they come under the denomination of bastard damask, and are usually woven in a harness of much greater power.

2

Mountings.

Another method of mounting the back-harness upon an improved construction, is exhibited in Fig. 7. In this mounting, the ends of the coupers A, B, are connected to their leaves, as in the diaper mounting. From each of the coupers B, over the centre of the web, is suspended a hook, *o*, which is kept back, when the loom is at rest, against the cross piece of wood C, by the weight *d*. D is another piece of wood laid across, and is nailed to two upright standards rising from the heddle-bearer, but which are omitted in the figure, for the purpose of showing the other parts of the apparatus. This piece of wood, D, prevents the centre ends of the coupers from rising above their horizontal position, and, consequently, the leaves from sinking below their proper pitch. P is the end of a lever resembling a treadle, whose centre of motion is above the weaver's head, and which is connected to the treadle T by the cord or wire *z*, descending through the warp. From each of the hooks *o*, a cord is taken round a smaller roller in the box *x*, and carried back behind the weaver, as in Fig. 5. and to which the handles or bobs are attached in the same manner.

Now, when the weaver pulls down any of the bobs, the hooks *o*, with which they are connected, will be drawn in below the lever P, and, by pressing down the treadle T, and securing it below the catch K with one foot, he works over the tweeling treadles with the other.

In some of these mountings, a barrel, formerly explained, is introduced at *a*, behind the hooks; and as the sheds come round, agreeably to the succession of any given pattern, the hooks are pushed in below the lever P, which sinks them, as in the preceding method.

It must be here observed, however, that in these and all other harnesses of the pressure kind, on account of the small weight on the front leaves when any shed is opened, they will not fall back to their places immediately after they are relieved from the weaver's foot. To remedy this, each leaf has a weight appended to its short march, and resting occasionally on its long one by a small piece of wood, in the very same manner as explained in the gauze-mounting. Sometimes these weights are suspended from the ends of the coupers, and rest on the side-rails of the loom.

Chap. III. Of the Draw-Loom.

The principles of this complex apparatus come in to the weaver's aid when those of the foregoing mountings are no longer practicable, and its powers are only limited by the views of the manufacturer or the demands of the consumer. Every branch of fancy-weaving, therefore, whose varieties depend on a multiplicity of leaves, may have its range of pattern still farther extended by the draw-loom; but as there is always some specific difference between the modes of producing patterns in these branches, the draw-loom will also assume various forms to suit the different purposes to which it is applied. Harnesses, Mountings. however, with regard to their mode of opening the sheds, may be divided into two kinds, namely, the *full harness* and the *pressure harness*.

In the full harness, each individual thread of the spotting or flowering warp is drawn through a separate mail, which has also its respective *tail* and *simple cords*, by which it may be raised independently of the others; and the flowering sheds are all opened directly by the harness. As the full harness, therefore, has the command of all the warp to the extent of one of its parts, the patterns or flowers which it produces may be delineated and shaded with the greatest precision and delicacy.

The pressure-harness is merely a contraction of the full one, in order to save a part of the cordage and other apparatus. In this harness there are sometimes two, three, four, five, or more threads drawn into each mail; and when any of these mails are raised, the threads are afterwards separated, and a shed formed by a set of leaves in front, as has been described under the back-harness. Hence, it will appear, that the fewer threads that are in each mail the nearer will the pattern approach to the perfection of a full harness; and, on the contrary, the more threads in each mail the more abruptly will the edges and other parts of the objects rise, and exhibit a degree of ruggedness that would be quite incompatible with many kinds of weaving, although both of these harnesses are occasionally employed in others.

There are some exceptions, however, to the preceding division of harnesses, such as the common spot harness which is neither, properly speaking, a full harness nor a pressure; but these are only different modifications of the same principle, and will be taken notice of in their proper places. For the present, therefore, it will be sufficient to describe the construction of the several parts of this extensive machine, and show how well they are adapted to open the sheds, in general, for any diversity of pattern.

Sect. I. *Construction of the Common Draw-Loom.*

Fig. 8. Pl. 46. is a general view of the Draw-Loom, mounted on the common principle; an explanation of the different parts of which will be given as we proceed with its construction.

The most essential part of the draw-loom is the harness, which is, in effect, the heddles comprised in a small compass by the omission of the shafts and other moving parts of the timber-mounting. It is the harness, therefore, which thus performs the office of the leaves in other mountings, that must be so modified as to produce patterns peculiar to any branch of weaving.

The harness is usually prepared in a frame made on purpose, which consists of two upright pieces of wood, fastened to each side of the loom, within, at the precise distance from the cloth-roll at which the harness is afterwards to be suspended. This frame will be seen at A A, Fig. 9. B is another piece of wood called a slabstock, which slides up and down in grooves, cut in the side pieces, and may be levelled and adjusted to any determinate height, so as to bring the eyes or mails to the position in which Mountings. they are to stand after the harness is tied. In the upper edge of the slabstock B is a groove, in which the lower ends of the mails are inserted; but a stout wire, somewhat flattened, must previously be run through these eyes to keep them of a uniform height, and by means of which they are also tied down tight, in several places, to the slabstock; all this will be apparent by inspecting Fig. 9. Sometimes the harness is constructed with eyes, instead of mails, similar to those of eye-heddles. When this is the case, a piece of stout wire, in the round state, answers the purpose of keeping them on a level, and affixing them to the slabstock.

Below the eye or mail, at the distance of about ten or twelve inches, are tied the leads or sinkers x, which are commonly made after the manner of wire, by drawing them through holes of different diameters in a plate of steel. These weights, which keep the harness duly stretched, and sink the mails after they have been raised, are attached, by taking one end of a piece of the harness-twine through the eye or under hole of the mail, and bringing both ends down below the slabstock B, one on each side as at a; and, after the twine is again taken through a small hole in the lead, both ends are knotted together, and the knot slipped down towards the weight, perfectly clear of the warp when raised. Sometimes both ends of the twine are taken through the hole of the lead, and then, taking them backwards, one on each side of the lead, they are knotted together, and adjusted as above. This is the most durable method of hanging the leads, as there are always two ends of the twine instead of one, to resist the friction. Through the upper hole of the mail is taken another piece of harness-twine; and this, keeping the mail in the bight or loop, passes double through a hole in the flat piece of wood, whose edge is seen at C, called the *hole-board*, and which is fixed about six or seven inches above the mails.

When the harness is made with eyes instead of the mails, they are formed on the round-wire above-mentioned; but a small slip of wood is likewise employed along with the wire, round both of which the eyes are tied, or rather double knotted; and the slip of wood is gradually drawn out as the operator proceeds, leaving the wire only in the eyes at last. This leaves the eyes perfectly easy, by which they may be shifted on the wire at pleasure.

The hole-board m, Fig. 8. the upper or flat side of which is exhibited in Fig. 10. is made of well seasoned hard wood, and pierced with a number of holes, equivalent to the number of mails in the harness; and so arranged, that each mail may stand directly opposite to its respective interval of the reed. That the greater number of mails may be comprised in a given breadth of a web, to adapt the harness to any set of reed, lines are drawn obliquely across the hole-board, and five, eight, ten, and sometimes twenty holes are pierced in each line: and the harness or mail twines are drawn in regular succession through these holes, similar to the draught over a set of tweeling-leaves. Thus, the hole-board must always be made to correspond with the reed; and if

Mountings. the hole-board should at any time be finer, a certain number of the holes must be passed over, in the same manner as weavers sometimes set their heddles.

For example, If a new hole-board were to be made for a 14^{00} reed, with four threads in each mail, and two threads in the split; then, it is plain that the hole-board must be so made that there will be one hole opposite to every two splits of the reed, and so of any other.

When all the harness or mail-twines, which, as formerly noticed, are still double, are taken through the hole-board, they are counted off in a regular or progressive order from one side, and divided into a certain number of portions, either equal or unequal, agreeably to the nature of the work for which the harness is constructed; and these portions or divisions are known by the name of *parts*. But when the number of mail-cords in each part does not complete the rows of holes in the board, the remaining holes must be left empty at the end, and the next part must begin at the same side of the board as at first. In such cases, allowance must be made for these remainders in calculating the board.

The next stage of the process is, to *beet* these mail twines, which is effected by knotting another piece of harness twine to each, to make them all of a length sufficient to tie, at the *neck*, to the ends of the tail cords, 1, 2, 3, 4, &c. Fig. 8. This is effected by casting a loop knot on one end of the additional twine, when the twine is used single, and forming it into a snitch, through which the two ends of the mail twine are taken; and, after drawing the snitch tight, a knot is made with the two ends, to prevent it from running. This enables the weaver to slacken or tighten any of the harness twines that may require this correction, after the harness is tied. When the additional twines are taken double, which is often done for the sake of durability, the two ends of the mail twine are knotted together, and a snitch formed, through which the two ends of the additional twine are taken, and knotted as above. These knots will be seen at *w y*, Fig. 8.

The *pulley-box*, or, as it is sometimes termed, the *whorl-box*, next claims our attention. This box, which is represented upon a small scale in Fig. 11. is placed in an angular position on the top of the loom, with its centre directly over the centre of the harness, in the frame or carriage at *c d*, Fig. 8. It contains a number of small pulleys arranged in rows from top to bottom, generally ten pulleys in each row, to correspond with ten spaces on the design paper, or one design of the pattern; and these rows are increased until the number of pulleys be equal to the number of mails in one part of the harness, or in any additional parts that may be necessary, such as the borders of shawls, &c.

The tail *m z m*, Fig. 8. comes next in order, which consists of a number of cords, one for each pulley, extending from the neck between *o* and *a*, to a considerable distance across the roof of the shop, and is sometimes 12 or 14 feet in length, if the breadth of the shop will permit. The tail is formed by warping the cords round two pins placed at the extremities of its length; and, when the number of cords thus laid together is equal to the number of mails in one part of the harness, a lease is formed, into which two small rods, or sometimes two pieces of cord are introduced. Mountings. The loops at one end being cut, those at the other are formed into snitches or running knots, five cords generally making one snitch, and these are fastened round a stick, at proper distances, to spread them out to the same breadth that they are to occupy in the pulley-box. The tail being fastened to the roof at the proper distance, the other ends of the cords are drawn through the box in regular succession, commencing at the top of the front row of pulleys, at *c*, Fig. 11. if the front-tail cord be first taken, or at the bottom of the back row, at *x*, if the back one be taken first; always taking care that the arrangement of the tail-cords over the pulleys correspond, in every respect, with the succession in which the mail-twines are drawn through the hole-board. This done, and a piece of wood fastened, during the time of mounting only, above the tail at *z*, to keep all the cords equally tight, and at a proper elevation, the whole is ready for *tying the neck*.

In order to explain this part of the process, it will be convenient to take an example upon a small scale, that the principle of the draw-loom may be exhibited to greater advantage, after which, the same principle and processes may be applied to the construction of harnesses of any requisite extent. Suppose, then, that a harness were to be mounted, capable of weaving any pattern to the extent only of forty mails, and that the same pattern is to be repeated four times in the breadth of the web. Here, it will be observed, that, as there are forty mails in each division or part, there will, consequently, be forty pulleys, forty tail, and forty simple cords necessary; and also, that, as the pattern is to be four times repeated on the web, there will be four mails connected at the neck to each cord of the tail; and thus the harness would be said to be tied in four parts.

All things being thus prepared, one or more persons, according to the extent of the harness, are appointed to pick out the harness-twines of each part from the hole-board in regular succession from one side, which, in this example, we suppose to be the right; and when the first twine of each part, which is marked 1 on the hole-board *m*, Fig. 8. is separated from the other, they are all handed up to the person who ties the neck, and he knots them as one to the first cord of the tail, which is also marked 1. By the time the first twines are tied, the persons below have the second twine of each part selected, in their order, which are handed up and tied in the same manner to the second tail cord, and so on, proceeding along each succeeding row of pulleys from bottom to top, or from top to bottom of each row, according as the tying commenced at the right or left side of the parts, until all the 40 mails are tied. Great care, however, must be taken, that all the twines from the several parts be tied uniformly tight, and that all the knots are at such distance below the pulleys, as to be clear of them when any portions of the harness are raised. In this the person who ties the harness is guided by a ruler or scale laid across from *o* to *a*, on which marks are made when the tail-cords should descend perpendicularly, and by which the height of the knots is also regulated, and kept in the same ho-

Mountings. rizontal plane. In Fig. 8. however, there are only ten of the mails tied in each part, to prevent confusion in the figure.

The *simple* or *symbolt* is now to be applied. This part of the apparatus, like the tail, consists of a cord for each mail in one part, or for each cord in the tail to which it is respectively tied. The simple is made in every respect the same way as the tail, but not so long, its extent being only from *z* to *x*, Fig. 8. One end of the simple is fastened to the piece of wood *x*, similar to that of the tail, and which is again made fast to the floor. A lease is also formed on the simple, and each simple cord, as noticed above, is taken in succession and tied to its corresponding tail-cord, immediately by the side of the loom at *z*. In large simples, so many knots crowded together would be liable to cause obstructions in the course of working, and, therefore, they are usually tied in two, three, or more rows, across the tail, at a moderate distance from each other, as exhibited in the figure. By this means the knots are more scattered, and have room to pass each other without much friction.

It will now be obvious, that by pulling down any portion of the simple cords, corresponding mails will be raised in each part of the harness, by which any variety and succession of sheds will be obtained. The expeditious selection of these cords, however, is of the greatest importance to the weaver; and for this purpose the *lashes, i,* are applied; one set of the lashes, *i*, being taken round all the simple cords which are requisite for one shed, a few cords only in each loop, the draw-boy has merely to pull these sets of lashes in succession, by which he obtains the simple cords for the several sheds with the greatest facility and dispatch. The lashes are made so as to slide up and down freely on the strong cord G, called the *gut-cord*, by a noose or head, to which each set is connected. It is common, however, to have two gut-cords, placed at a little distance from each other, between which the lashes are divided by alternate sets. All the sets of lashes are again connected by the small cords *n*, called *bridles*, by which, when any one set has been employed and set past, its successor is drawn down from among the others, to lie in readiness for the next lift.

As the mails near the centre of the loom would rise higher, or have a greater perpendicular range by the same pull of the simple, than those that are tied to the more oblique twines, a number of rollers are introduced immediately below the knots at the neck, 1, 2, 3, &c. each row of tail-cords across the box rising between two of these rollers, the ends of which run in two pieces of wood, one nailed on each side of the frame at *o, a*. By this means, all the mails are raised to the same height, and consequently the sheds will be of the same uniform depth throughout.

When the harness is thus constructed, the piece of wood that kept the tail-cords in their proper position at *z*, is taken down, and the twine is drawn out of the mails. Before the slabstock be taken out, however, a shaft or rod is put into its place, and the harness is then ready to receive the warp.

If we now take a retrospect of the preceding processes and descriptions, it will appear that when the mail next the right hand selvage is connected to the first tail-cord, counting from the lowest pulley in the back row of the box at *x*, which is the order adopted in the present example, every succeeding tail-cord towards the front will be connected to the succeeding mail of each part, counting towards the left. Or, had the tying commenced at the top of the box, and on the front row of the pulleys at *c*, the first tail-cord, counting from the front, would be connected to the first mail of each part counting from the left; in either of these cases, the tail being still supposed to extend to the right side of the shop when the weaver is on his seat, the apparatus is called a *right hand harness*,—but a *left hand harness*, when the tail is extended on the weaver's left hand, and the connections formed accordingly. Mountings.

Again, in this example, the tying of each of the four parts commences at one side, and continues in regular succession until all be tied; but had the first mail of each of the two parts towards the right, and the first mails of the other two parts counting from the left, been tied to the first tail-cord, and the others in progressive order towards the centre, this would have constituted what is termed a *gathered harness*, and its effects would be, that the pattern of figures produced by the right hand parts would incline one way, and those produced by the other two parts would lie in the contrary direction, that is, if the tops of the flowers in the right side parts were bent towards the centre of the web, the flowers produced by the other two parts would incline towards the centre also, facing each other.

It is further to be observed, that were the example before us to be considered only as the body of a shawl, and that a border were to be added at each side, to the extent, for instance, of thirty nine mails, then it is evident thirty-nine pulleys more of the box, Fig. 11. must be occupied, and that two mails only, one from each border, would be tied to each of the additional tail-cords. If, therefore, the tying at the neck had commenced at the first pulley on the top of the box at *c*, the body would all be tied first, and the tying of the borders would have followed in the same order of succession over the pulleys, from top to bottom of each row, until all the thirty-nine tail-cords were tied; and, consequently, the fortieth pulley, at the corner *x*, would be left unoccupied. In this case, the mails of the border, next the body, would be first tied; so that those in the right hand border would be taken like the other parts from left to right; but in the left hand border they would be tied from right to left.

On the other hand, had the tying commenced at the lowest pulley of the back row at *x*, the borders would have been tied before the body, and the mails of border nearest their respective selvages would have been tied to the tail-cord farthest from the weaver when on his seat, and all the other mails as they approach towards the body would have been connected to their respective tail-cords in regular order as they were nearest to the front. In this case, therefore, the left hand border would be tied from left to right, and the other from right to left; and the fortieth pulley would, of course, be left unoccupied in the top of the box at *c*. The tying of

Mountings. the body would commence at the lowest pulley in the fourth row from the point at g, and continue on as in the first example, the mails of each part being taken from right to left.

These lengthened details, in which the draw-loom is exhibited in so many points of view, cannot fail, it is presumed, of giving the reader a thorough knowledge of its construction and operation. We should now proceed to shew how the designs are applied to the simple, in order to produce any proposed pattern; but it will first be necessary to take some notice of the paper on which these patterns are designed, as it is of the greatest use in the several branches of fancy weaving.

Sect. II. *Of the Design Paper.*

This paper is an impression of an engraving, and is composed entirely of straight lines, crossing each other at right angles, the spaces between which representing the threads of warp and woof in any piece of cloth,—and is useful both for drawing or designing patterns previously to their being applied to the simple of the harness, and for analyzing the textures of cloth, when we wish to investigate the extent and variety of the draughts or mountings by which they were produced.

There are several kinds of design paper, which are, in some measure, adapted to the different proportions of warp and woof in different fabrics; but that which is in most general use is 10 by 10, that is, ten spans counted by the warp and ten by the woof in each *design;* and then larger spaces or designs are bounded by stronger lines than the others, for the convenience of designing and reading off the patterns.

Hence it is evident, that were all the fabrics that require design paper made with even warp and weft, the paper 10 by 10 would answer all the purposes of designing; but as the proportion between these varies with almost every fabric, different species of design paper have been found advantageous, in order to maintain, according to circumstances, a due proportion between the length and breadth of patterns when they are woven on the cloth. It were, however, equally endless and superfluous to appropriate a particular species of paper to each fabric that requires it, and therefore, in addition to that of 10 by 10, the following proportions are in use; namely, 8 by 9, and 8 by 10 have been adapted to tweels; 8 by 12, and 8 by 13 for gauze; and 8 by 20 for a peculiar species of the pressure harness; and these have been found to embrace all the common variety of fabrics which are at present ornamented in the cotton manufacture; 10 by 10, however, being most common, may easily be adapted to any other fabric by a little attention. This is effected by extending or lengthening the figures from bottom to top of the design paper, proportionally, for fabrics which are closer by the weft than by the warp; or by the breadth, for such as are thinner. Thus, if a pattern were drawn on design paper, 10, by 10 for a 12 hundred ground, to have 18 shots of woof,—this pattern, to make it square on the cloth, must be drawn longer on the design paper than it is broad, in the proportion of 18 to 12, or of 3 to 2.

When we wish to examine any piece of cloth or fancy loom work, in order to discover the nature and extent of the mounting by which it was produced, we take a magnifying glass, such as the common web-glass, and count or note all the variety in one set of the pattern, which is easily determined by the regularity with which it is repeated. Then, suppose we examine the upper side of the cloth as it stood in the loom, we note where all the threads of warp cross over the threads of woof, and by marking corresponding spaces on the design paper, a complete representation of all the lifts or sheds will be obtained which were necessary to produce the pattern.

Sect. III. *Of designing Harness Patterns, and reading them on the Simple.*

When a pattern for any kind of harness is to be designed, the number of simple cords must be given, these, as formerly observed, being always equal to the number of mails in one set of the pattern; and when an equal number of the smaller spaces is counted off on the design paper, numbered from right to left, it will give the full range to which such patterns can be extended by the warp. In like manner, when the number of lifts or sheds which the harness must form while weaving one set of the pattern is counted upwards to the top of the paper, the limits will be ascertained to which the pattern is to be extended by the weft, provided it be only of one cover, that is, only one kind of weft for each space.

Then, in some cases, where the figure or the design will be nearly of a size with the pattern on the cloth, the outlines of the pattern, flower, or figure, may be sketched with a blacklead pencil upon this portion of the design-paper, or upon such parts of it as are to be figured; after which, the design may be finished by colouring the smaller spaces of the paper, which represent the several mails that are to be raised in forming the different flowery sheds. This, when the pattern is uniformly of one colour, is commonly done with vermilion mixed with gum-water, and laid on with a camel's hair pencil. Carmine mixed with a little spirits of hartshorn, is also sometimes used, which gives the design a more lively appearance than the vermilion.

When the pattern contains a diversity of colours, the same colours are also painted on the design, in the very same order as they are to be inserted by the weaver, and this serves as a guide in taking the supernumerary lifts or sheds of the harness. The water colours which are sold in the shops are generally used for this purpose. For some species of weaving the patterns require to be painted solid; but in most cases the principal objects are tweeled or flushed, agreeably to the nature of the design.

When sprigs or detached figures are to be designed, they are commonly set at equal distances from each other; and very often one row is thrown into the bosom of another. For the plains, therefore an equal number of simple cords, or spaces, must be left out of the design at one side of each sprig; or, if the spaces are large, they are usually divided into two, one-half being omitted before, and the other after the sprig. In designing all-over or running patterns, care must be taken, where the stalks or other members join, to avoid stiffness, unnatural turns, or large vacuities. At these joinings, the stalks, or other running objects, may be continued

Mountings.

or extended on common paper beyond the limits of the design, both by the length and breadth, if necessary, until they be completed, or the sweeps and bindings of the stalks and branches be fully ascertained, and then transferred to the opposite sides of the design paper.

It very often occurs, however, that the pattern is first drawn on common paper, of the exact size that it will assume upon the cloth. This size is determined by first finding the number of splits of the intended reed which the pattern will occupy; and then taking the extent of that number of splits in a pair of compasses, from a scale of porters and splits made for that purpose. But here it will, in most cases, be necessary to enlarge the pattern to a size equivalent to the space which it will occupy on the design paper. This is always the case when a given number of mails occupy less room than the same number of spaces on the design paper; for should they occupy more room, the design must be diminished in proportion. This is done by making a second sketch of the pattern upon common paper, equal to the dimensions of the design found by the number of simple cords and lifts of the harness, as above directed. Then, having a sheet of common paper rubbed well with blacklead powder on one side, this sheet is laid upon the design with the blacked side downwards, over which is laid the enlarged or diminished design, and with a pointed instrument, somewhat blunted, all the outlines and other principal objects of the figure are traced over, and the blacklead will leave such traces as will be sufficient to finish the pattern by.

To those who are unacquainted with drawing or hand-sketching, the process of enlarging or diminishing the original design will appear somewhat difficult; but there are several methods by which this difficulty may be overcome, even by those who have little or no previous knowledge of drawing, and yet may have a desire to put any pattern they may chuse upon the design paper. The following method will give a learner some idea how this may be effected: Divide the original design into a number of squares, by drawing lines across it at right angles, making each side of the squares equal to the extent of the number of splits in one design, for the given set of reed; and the figure thus be divided into square spaces corresponding to the designs on the paper, but smaller in proportion as the reed is finer. Should the squares of the original be too small, as will be the case in very fine reeds, the extent of two designs may be set off round the pattern, and each of these squares will be equivalent to four of the larger spaces on the design paper. The pattern may now be copied from the original, by observing what particular parts or members of it are in any square of the latter, and drawing similar parts on a corresponding square of the design paper; continuing this process until the whole be sketched over; by which procedure an exact delineation of the figures will be obtained, from which the whole may be finished as above directed.

But a more accurate and expeditious method of reduction, either for a learner or proficient, is by means of an instrument called the pentagraph, which is sold in the shops, and which is usually described among drawing instruments.

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The design being thus completed, the pattern is next to be read on the simple: and in order to facilitate this operation, each simple cord is placed into a separate interval of a reed, commonly about a five or six hundred, which is open at one side like a comb, one interval being left empty after each design, for the more readily counting them off. As each cord of the simple corresponds to a particular space of the design-paper, those cords which relate to the spaces on which the several lifts of the harness are marked, must be selected and separated from the others, by a set of lashes for each shed in the pattern. One person reads the flower, and another, with a long needle and cord through its eye, selects those simple cords which are mentioned by the person who reads the design. When one set of the simples is taken in this manner, the cord in the needle is drawn through between them and the others; and thus, by taking a separate turn of the cord round the simples for each lift or shed, all the pattern is read on before the lashes are applied. But this will be better understood by an example.

And here, as in the construction of the draw-loom, we shall suppose the harness to contain only forty mails in each part, in which the pattern Fig. 4. Plate 47. is to be woven. In this pattern, it will be observed, there are only 17 spaces occupied by the figure as warp; and, consequently, there may be two of these figures woven in one part of the harness, and six cords over; three of which, for a plain, may be omitted before each sprig. Counting the spaces from top to bottom of the design, it will be found that 23 lifts or changes of the harness are necessary to produce one of these figures. But as there are two additional colours likewise to be introduced in different parts of the flower, additional lashes must also be applied for these colours; and these are taken alternately with the principal ones of the design.

The simple cords being all placed in the reed in regular succession, as before noticed, the person who reads the flower then gives the direction for the first set of lashes,—pass 5 and 4, take 4 and 3; 4 left; that is, he counts off the nine blank spaces on the right of the bottom line of the design paper, and would have said, pass 9, take 7, as there are in all nine spaces blank and seven to be taken: But, in order to prevent mistakes, whatever is to be taken or left in each design is kept separate and distinct from the others; and, as the strong line which divides the designs comes in after the first five blank spaces, he gives the direction take 5 and 4, as above. For the same reason, the spaces which are taken are divided into their respective designs, and the four remaining blank spaces are mentioned. The person who takes the simples then passes over the nine cords at the right, takes up the seven marked ones on his needle, and omits the remaining four at the left. For the second lift the direction is, pass 5 and 6, take 2 and 1; 6 left. For the third, pass 5 and 2, take 4; pass 1, take 1; pass 1, take 4; 2 left. The fourth, pass 5 and 1, take 2; pass 3, take 1; pass 1, take 1; pass 3, take 2; 1 left. As there is now ano-

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ther colour to be introduced when the figure is painted red, the reader would give the direction to pass 5 and 3, take 3; pass 3, take 3; 3 left. The next principal lift is taken as described above; and the direction for the second colouring lift is, pass 5 and 2, take 3; pass 1, take 1; pass 1, take 1; pass 1, take 3; 2 left; and so on, till the whole be read over.

Now, in the reading of this flower we have taken the 20 simple cords which are supposed to be at the right side, and always commenced the reading and taking at the right hand: consequently, when the bosoming sprig is to be put on, we must take the remaining cords towards the left; and, in order to reverse the position of the figure upon the cloth, the person who reads over the pattern commences at the left of each space, and proceeds to the right, while the one who takes commences at the centre of the simple, and goes on towards the left, as in the former case. The first direction, therefore, would be, pass 2 and 5, take 3 and 4; 4 and 2 left: that is, by including the three unoccupied spaces, two of which are in one design, and five in the other; and so on, in every other respect, as at first. In practice, however, the word *pass* is generally omitted; and the person who reads the design simply mentions the number to be passed, but retains the word *take*.

When the design is thus read on the simple, the next part of the process is to apply the lashes. For this purpose, the simple cords are transferred from the reed to another frame called a *ravel*, in which they are divided into small parcels by pins, and the ravel is placed a little way above the flower. The number of simple cords in each interval of the ravel may be varied, according as the quantity of warp to be raised by each is greater or smaller, coarse or fine; so that there may not be too much stress on any one lash in pulling them out. The person who attaches the lashes then separates the simple cords of the last taken lift of the harness from those that were missed, by which all the simple cords for that shed will also be divided into small parcels by the pins of the ravel. He then takes a separate turn of the lash twine round each parcel, and another turn round his finger, alternately. After cutting the twine and knotting the two ends together, the loops which were on his finger are twisted together like a cord, and a kench made, by which the whole set of lashes are fastened to the *head*, which is the noose that slides up and down on the gut-cord. In this manner he proceeds until all the lashes are tied, after which he applies the *bridles*.

But as this method of transferring patterns from design paper to the simple of a draw-loom, though long in use, and still generally practised, occupies two men for a considerable time in reading over the design and taking the simple cords, besides the time that is afterwards necessary to apply the lashes, another method has lately been adopted, by which the labour of the two persons is entirely superseded, and the lashes applied directly from the design paper. The method alluded to is this: The simple cords A are fastened to the cross bar B, in the frame, Fig. 7. and each cord is placed in an interval of a reed at C, which is open at one side like a comb; and is so adapted that each simple-cord may stand exactly opposite to that space on the design to which it corresponds in the pattern. The other ends of the simple-cords are fastened to another cross bar at the back of the frame, but which is here omitted, to prevent confusion in the figure. One end of the design is wound round the roller D, and the other is fastened to another roller behind the reed C, by pasting a piece of spare paper to the edge of it if necessary. E is a flat piece of wood, or ruler, which slides up and down in grooves cut in the sides of the frame, to guide the operator when he is selecting the simple-cords.

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The simple and design being thus placed in the frame, and the ruler E set immediately above the first space or lift of the pattern, the operator, after fastening the end of the lash twine round the pin *a*, counts off a simple cord for each space of the design that is to be omitted or passed over, beginning at the left, and takes the twine round those cords that are to be taken, brings the twine round the pin *a*, takes it again round the next parcel of cords that are marked to be taken; and so on, taking always a turn of the twine round the pin *a*, between each parcel taken up. When a great number of simple cords are to be taken in one place, they must be divided into smaller portions, by taking a turn of the lash twine round the pin *a*, to prevent too much stress being made on any single lash.

For example: The ruler E being set for the third space or set of lashes, two simple cords are passed over for the two blank spaces at the left side of the design; then having fastened one end of the lash twine at or near the pin *a*, the operator takes the twine round four simple cords, for the four spaces that are marked on the design; brings it round the pin *a*, misses one simple cord for the blank space in the pattern, takes it round the next cord, and also round the pin; then passes one cord, takes it round the next four, which completes this set of lashes; after which he ties both ends of the twine together, and takes out the pin. The loops of the lash twine that were formed by the pin are now twisted round like a cord, and left to hang over the bar *m*, till the remaining lashes are formed in the same manner.

It may be here observed, that, in order to facilitate this process, an interval of the reed must be left empty, or a pin inserted, opposite to each of the strong lines that separate the designs; and, by taking or leaving one, two, or more of the cords nearest these marks, as occasion may serve, the operator will soon acquire a dexterity in selecting the simple cords, which will enable him to apply the lashes in less time than by the former method, exclusive of the time occupied by the two persons in reading over the pattern.

It is farther to be remarked, that in this example the simple is supposed to be disengaged from the tail; but it is equally easy, when the simple is attached to the harness, to loose it at the foot, and place it in the frame at the side of the loom. But in many cases, especially in damask factories, a false simple is employed for reading on the flower, and, instead of applying the lashes as in the example here given, a piece of lash twine is drawn straight through where the simple cords are separated, after the manner of a shot of woof. When each cord of this false simple is tied to its corresponding cord in the tail, or simple, as most convenient, each shed of the harness will be readily obtained from these cross cords, either for applying the lashes, or working a few sets of the pattern, which is all that is sometimes required. For if the cords, as they are drawn out of the sheds of the false simple, be again inserted in the corresponding sheds of the real simple, or tail, and so changing them from one to the other, as many patterns as may be required may thus be woven without applying any other lashes. It should likewise be added, that the cross piece of wood *m* in the frame, Fig. 7. keeps the simple cords all in a line, and equidistant from the pin *a*; and that the piece of wood *a* should be moveable on the side pieces, so that it may be placed at the distance from the piece *m*, according to the intended length of the lashes.

Sect. IV. *Of some recent Improvements on the Draw-Loom.*

An apparatus that will effectually supply the place of a draw-boy, in every possible case to which the draw-loom can be applied, has long been, and still is, a very great desideratum in the art of weaving. Some very ingenious improvements have lately been made, with a view to accomplish so desirable an object; but, although these are found to answer the purpose to which they have been applied, even beyond expectation, their principles are still limited to particular cases. The success of these efforts, however, strongly induces us to believe, that an apparatus of this kind, upon general principles, is neither impracticable, nor its discovery at a very great distance. The three following methods of mounting a draw-loom, to work without a draw-boy, appear most deserving our attention in this place.

1. *The Patent, or Comb Draw-Loom.*

This improvement on the draw-loom was made at Dunfermline some years ago, and has hitherto been chiefly confined to the manufacture of damask. Fig. 1. Plate 47. is a front view of this mounting, adapted to weave what is called a damask napkin. A A is the bearer or carriage; *n* is the *cammerale* which supports the harness; *m* is the false cammerale, to which the knot-cords are fastened; *x x*, knots upon the tail, which, in this mounting, is perpendicular; *z z*, two supports for the comb, a representation of which, as viewed from above, will be found in Fig. 5. and an edge view in Fig. 6. The teeth are usually made of harder wood than the body of the comb, and inserted as represented in the Figure. The comb is placed on its pivots, below the knots at the dotted line *z z*, Fig. 1. with the teeth pointed a little downwards. Below the comb, and between *s* and *s*, are tied the simple cords, which, passing horizontally over the weaver's head, are fastened to the roof of the shop. *o o* is the *haik*, which regulates the neck of the harness in the same manner that the pulley-box does in the preceding mounting. A plan of this haik, as adapted to 15 times 10, or 150 cords, will be found in Fig. 3.—*r r*, are rings, or rather loops made on the cords which are attached to the cammerale *n*, and to which also the knot-cords are respectively tied. But as the cammerale, *n*, supports the whole weight of the harness, the knot-cords are left a little slack, so that they may be easily drawn in between the teeth of the comb by the simples.

In narrow, or light mounted looms, however, the knot-cords support the whole weight of the harness; and therefore the cammerale, *n*, is unnecessary, as the upper one, *m*, supplies it place. Behind the loom a cord is tied to each of the knot-cords, or very often a continuation of the simple; and these cords, after passing through a small frame resembling the haik, or else an old pulley-box, are kept tight by leads or other weights appended to them, and serve to draw back the knot-cords expeditiously to their perpendicular position when relieved from the comb. These are called back ballesters, and are only necessary when the false cammerale is employed.

To one side of the comb is nailed a handle or lever, which, when pulled down, raises the indented edge, or teeth, after the knot-cords have been drawn in between them by the lashes. For this purpose, a strong wire or cord is fastened to the end of the lever, and descends through the warp in broad webs, or past the selvage in narrow ones, and is fixed by the other end to a stout treadle below, clear of those which are necessary for the ground. Hence, when any shed is to be opened by this harness, the weaver pulls down the corresponding set of lashes, which draw the knot-cords of that shed between the teeth of the comb, while he presses down the stout treadle above-mentioned with his foot, and places it in a catch below, when it remains so long as he has occasion for that shed.

This harness is prepared in the frame, Fig. 9. Plate 46. in the same manner as that formerly described, so far at least as taking the mail-twines through the hole-board. It is not, however, tied at the neck like the former; for the harness twines, or those that extend from *t* to the neck, are here connected, first to the knot-cords a little below the haik, and afterwards to the mail-twines at a suitable height, *t*, above the hole-board. The succession of tying up the mail-twines is also different, being tied in courses by the length of the hole-board, instead of crossing it as in the former case; so that whatever number of holes may be in each oblique line of the hole-board, the same number of such courses will be in the harness.

But as this harness is divided into parts, in a manner very different from that at first described, it will require some farther explanation. In weaving damask, it is very common to introduce both single and double mounting into the same harness, in order to give a greater diversity to the patterns by a given number of simple cords. The parts called single mounting have the same effect as those into which the first harness was divided; and what is called double mounting, resembles similar parts of a gathered harness. The spaces marked 1, 2, 3, 7, 8, on the edge of the hole-board B, Fig. 1. each space denoting one design, are single parts, and all the others are double; and the double parts generally diverge from the single on each side, as from a centre. It is also customary to substitute a ravel, such as is employed for beaming a web, for the hole-board, the

Mountings. pins of which serve to divide the harness into designs or other portions; and the mails in these portions are again separated by cords extending from one end of the ravel to the other. A representation of this substitute for the hole-board, which in this species of weaving is called the harness-reed, will be found in Fig. 2. and which is numbered in the same manner as at B, Fig. 1.

Now, in tying harnesses of this kind, a certain number of harness twines, or those which extend from *t* to the neck, are connected by loops to each of the knot-cords, agreeably to the number of mails that are to be attached to each; and these parcels, for example, are taken through the diagonal spaces of the haik, Fig. 3. commencing at the corner space 1, 1, and taking the spaces in regular succession across the haik from 1 to 10. The others are drawn through in the same order, commencing always on the back course with the first of every ten knot-cords. The mail-twines are drawn in rows across the harness-reed, Fig. 2. in the very same manner.

These arrangements being made, the operator commences with the three designs of single mounting in the centres of the side borders, which are marked 1, 2, 3; and as there is only one mail in each of these parts to be attached to each knot-cord, he connects the two twines 1, 1, in the borders, to the knot-cord marked also 1 on the haik *o o*, by knotting them at *t*. The second and third mail-twines of these parts are also connected respectively to the second and third knot-cords, marked 2, 3, on the haik, which finishes the first course of single mounting in the borders. The remaining parts of the borders being double, four mails, one on each side of the single parts, are next connected to the fourth knot-cord; these are pointed out by the figure 4, on the harness-reed B. The mail-twines, 5 and 6, are connected to the knot-cords 5 and 6, respectively, which completes the first course of the borders. The single parts, 7, 8, in the body of the napkin, are next tied to their respective knot-cords 7, 8, at the haik; after which, the mails, 9, are tied to the ninth knot-cord, 10 to the tenth, and so on till all the course be tied. The other nine courses are tied in the very same manner, and in the order pointed out at the end of the harness-reed, Fig. 2.

2. *Mr Ferguson's Draw-Loom.*

The draw-loom, a front elevation of which is given in Fig. 8. and a ground plan in Fig. 9. was mounted by Mr Alexander Ferguson, Glasgow, about a twelvemonth ago, and applied to the weaving of damask shawls. The principle on which this mounting is constructed is the most simple, perhaps, that can be looked for; and, could it be applied with facility to the draw-loom in all its departments, it would certainly be an invaluable acquisition to the art of weaving.

In this draw-loom, the harness-twines, instead of being tied to the tail, or knot-cords, as in the preceding methods, are taken up through a small hole-board, *a*, which is fastened to the carriage, and then tied to a number of little rings, each ring supplying the place of a knot or tail-cord. There are two rows of holes in this hole-board, and the twines are taken through a hole in each row alternately. The rings, therefore, by resting on the hole-board, support the whole weight of the harness. The lever A works between two strong wires, bent as at *c*, Fig. 8. and inserted in the carriage as at *c c c c*, Fig. 9. On each of these wires is a number of other smaller rings, through which the cords *u* pass, that raise the lashes *x*. These rings are seen at *e*, Figs. 8. and 9.

In reading any pattern on this harness, the rings on the hole-board, which are to be raised to form each shed, are selected, as pointed out by the design, in the very same manner as the simple cords in the preceding draw-looms; and when the lashes are applied, they are connected to a cord *u*, which, after passing through a ring, *e*, on one of the wires, runs across, and passes through another ring, *e*, on the opposite wire, where it is again fastened to the same set of lashes.

Now, it will evidently appear, that when the long end of the lever A is taken down by the treadle *t*, the cross cord *u*, and consequently all the rings and mails attached to it, will be raised by the other end; and as each cord, *u*, runs towards the perpendicular, it will pass over the bent *c* of the wires, and fall into the hollow part of the lever when it is relieved by the treadle. The succeeding cross-cord, *u*, is brought into the same situation which the other left, by the bridles i, which connect the cross cords of the several lifts at equal distances, and places each successive cord in a proper position to be lifted on the point of the lever at each tread.

As this draw-loom is at present employed in weaving damask, in which there are eight treadles to be wrought over between each change of the harness, the treadle *t*, when pressed down, is secured in a catch knocked into the ground, in the manner explained in the diaper-loom, and relieved again by the foot when a new shed is wanted.

The improvements which are proposed to be made on the draw-loom by the inventor, are, first, to counter-balance the short end of the lever A by a piece of lead fixed to it, so as to sink it always below the cross cord *u*, when left at liberty. This will be much more convenient than the pulley and weights *w* in the figure. And, secondly, in place of working the lever by the treadle *t*, it is proposed to have a small iron-catch upon a spring, fixed between two pieces of wood, attached somewhere to the side of the loom, as at B, and between which the lever A is also to work; and by connecting the lever, by a march, to any one of the tweeling-treadles, when that treadle is pressed down in its turn it will draw the lever into the catch, where it will be retained until the weaver has occasion to change the shed, which he can effect by pulling a cord, one end of which is tied to the spring-catch, and the other to a handle on the upper shell of the lay.

3. *Mr Cross's Draw-Loom.*

This apparatus, the invention of Mr James Cross, foreman in Paisley, and by him called the counterpoise harness, has been successfully applied, within these last twelvemonths, to the weaving of imitation-shawls and gown-pieces. The advantages which this draw-loom possesses over any of the preceding, are, that the harness sinks, as well as raises, part of the warp in opening the sheds, and that there is no time lost in drawing the simple cords, or otherwise changing the harness-sheds; for the connections for these movements are all made with the treadles that are otherwise employed for the ground or spotted parts.

Fig. 10. is a front elevation of this draw-loom. A and B are the ends of two cylinders, to the first of which the knot-cords are fastened, as to the cammerale *m*, Fig. 1. Into the cylinder B is inserted a small comb, or reed, immediately below the knots at *a*; and *b* is a band passing round both cylinders, so that when the one is turned round it communicates the same motion to the other. C is another cylinder, round the circumference of which the pattern is designed. On one end of this cylinder is a rachet-wheel, having one tooth for each lift or shed of the harness. The circumference of this cylinder is usually made of sheet-iron, and perforated with a number of small holes, which are arranged in the same order as the pattern or design-paper; that is to say, if the design, Fig. 4. were pasted round the circumference of this barrel or cylinder, and all the little squares which are marked for the pattern were cut out of the sheet-iron below, it would then be prepared for weaving this figure. *c* are small needles made of wire, one for each knot-cord; each of which is fastened by a joint to the lever *d*. It will now appear by the Fig. that when the points of the needles *c* press against the cylinder C, the knot-cords to which they are connected will be prevented from falling among the teeth of the comb *a*; and therefore, though the cylinder B be turned round, the harness will not be affected. On the other hand, wherever the needles find a passage through the circumference of the cylinder C, which will always be the case when the pattern is cut, the corresponding knot-cords will fall into the comb; and, consequently, the mails attached to them will be raised when the cylinder B is turned round in that direction. *e* is the end of a frame-lever, which, when pulled round by the crank *f*, takes all the needles out of the pattern cylinder, and allows it to shift one tooth of the ratchet. *g* is a catch which turns the crank *f*. This catch is directed to the lower end of the crank in its descent by the end of a lever, which slides down an inclined plane, at the bottom of which it escapes, and the crank *f* is disengaged before the treadle which pulls it down arrives at its full depth. This movement is performed by the treadle *s*, which is also employed to raise and sink some of the front leaves without the loss of any time for this purpose. When the treadle *t* is pressed down, it turns round the cylinder A by means of the cord *h*, by which all the knot-cords are slackened, and consequently the harness is sunk; while at the same time the cylinder B is also turned round by the band *b*, which raises the comb and such of the knot-cords as are among its teeth. The small levers, *m*, *n*, are constructed to gain mechanical power towards the end of the motion, to equalise the exertions of the operator, he having then an increase of resistance from various causes.

PART III. PRACTICAL WEAVING.

Having explained, in the preceding Part, the construction of the principal apparatus employed by weavers for opening their sheds, we come now to investigate the practical department, and shew how the several textures of cloth are produced.

When we speak of texture, we mean that peculiar mode in which the threads of warp and weft are interwoven, without any regard to fabric, which has been already explained. The textures which are most distinguishable in the art of weaving are six, namely, plain cloth, tweeling, flushing, spotting, double cloth, and crossed warps; for from these and their combinations arise all that variety that is observable in the manufactures of this country.

Chap. I. Plain Texture.

As this is the most simple, so it is by far the most extensively useful branch of weaving. Almost all our broad and narrow cloths, linens, cambrics, calicoes, jaconets, ginghams, &c. are of this texture. It requires only two leaves of heddles, and the weft is interwoven with each alternate thread of the warp. Fig. 1. Plate 48. will explain the principle of this texture. It contains a plan of the mounting, agreeably to the description of draught and cordings formerly given, with a specimen of the cloth annexed. The warp threads, as will be observed, are drawn alternately on the two leaves, and when the treadles are also pressed down alternately they produce the texture at A. The manner in which this texture is represented on design paper will be seen at B; and the whole is so plain, that it is presumed no further explanation is necessary.

Chap. II. Tweeling and its Varieties.

The texture of tweels is formed by passing the threads of weft over and under certain portions of the warp at regular intervals, by which a greater quantity of materials may be brought together, and a much closer fabric produced, than by the plain texture.

Tweeling is susceptible of considerable variety, arising chiefly from the number of leaves employed, and the order in which they are raised and sunk; and sometimes a diversity takes place in consequence of changing the succession of the draught. These varieties, however, may, without much impropriety, be all classed under the three following heads, viz: Regular Biased Tweels, Broken or Satin Tweels, and and Fancy Tweels.

Sect. I. *Regular Tweels.*

In these tweels the warp-threads are drawn in regular succession over the leaves, one thread on each, and one leaf only is raised by each treadle, all the others being sunk. The lowest tweel we can produce is that woven by three leaves, in which every third thread of warp is raised or sunk in succession, the weft passing either above or below the other two. This tweel is chiefly employed in weaving blankets, fustians, and some of the coarser kinds of cloth. In the four-leafed tweel, the weft passes over or under three threads of warp, and is only interwoven with the fourth. The same is to be understood of the five-leafed tweel, or any other, according to the number of leaves employed. Hence, by increasing the number of leaves, we extend the intervals at which the weft is interwoven with the warp, and, consequently diminish the resistance which the warp opposes to the weft threads coming into contact. Figs. 2. 3. and 4. Plate 48. are plans of the three, four, and five leafed tweel mountings respectively; and the intervals at which the weft is interwoven with the warp, are pointed out on the design paper annexed.

Sect. II. *Broken or Satin Tweels.*

In the preceding tweels, the small stripes formed by the intertexture of the warp run obliquely across the cloth to the right or left, according to the direction in which the weaver chooses to work over his treadles; but in broken tweels this regularity is interrupted, and the threads of warp are raised at different intervals, depending, in general, on the number of leaves by which they are produced.

Of broken tweels, some are perfect and others imperfect. Tweels are perfect when the leaves are all raised at intervals equal to each other; imperfect when the number of leaves in the mounting will not admit of this uniformity. Fig. 5. is a plan and specimen of the four-leafed broken tweel, sometimes called the satinet tweel. Here it will be observed that when the treadles are pressed down in regular succession, according to the order of the numbers 1, 2, 3, 4, the leaf 1 is first raised, the leaf 3 next, the leaf 2 by the third treadle, and the leaf 4 by the fourth. Hence it occurs, that sometimes two contiguous leaves rise in succession, and sometimes there is an interval of one between them, and this irregularity cannot be avoided in breaking the four-leafed tweel. The five-leafed tweel is perfect either by raising every second or third leaf in succession, and six leaves make an imperfect tweel, similar to that by four leaves. Seven leaves produce a perfect tweel by passing one leaf and raising the next alternately. The eight-leafed tweel, commonly called the damask tweel, is perfect, by omitting two leaves and raising the third. Specimens of the five and eight-leafed tweels will be found in Figs. 6. and 7. From these examples, the properties of any higher number of leaves for producing tweels may be easily investigated.

Sect. III. *Fancy Tweels.*

Under this head may be classed all those tweels which are not comprised in the two preceding sections, and which may in general be distinguished from them by having more leaves than are raised by each treadle. Fig. 8. is the common serge tweel, in which two threads are raised and two sunk by each treadle. Fig. 9. is an eight-leafed fancy tweel, with four leaves raised and four sunk. Tweels of this description may be produced in great abundance, either by increasing the number of leaves, or changing the arrangement of the raising and sinking cords upon th treadles. Fig 10. is a specimen of what is called pillow tweels, or herring-bone, in which two threads are always raised and two sunk, like the serge tweel; but the draught runs once and a half over the leaves in one direction, and returns in the same order, which inverts the figure.

Sect. IV. *Turning or reversing the Tweel.*

As all the regular and broken tweels may be formed either by raising one leaf and sinking the others, or by sinking one leaf and raising the others, it follows that a greater proportion of the weft than of the warp will be thrown to that side to which the single leaf is always directed. Hence, were the warp and weft of different colours, the colour of the weft would prevail on one side of the cloth, while that of the warp would appear to more advantage on the other. If, therefore, we apply a second set of treadles to any of these mountings, with the plan of cording reversed, we shall be able to make the warp or weft prevail on one side at pleasure, as often as we change from one set of treadles to the other, by which means, alternate stripes will be formed, crossing from one selvage of the cloth to the other.

But in order to produce tweeled stripes running by the length of the cloth, we must add another set of tweeling leaves, and draw certain portions of the warp on each, agreeably to the size and form of the pattern. If, then, the cording plans of the two sets of leaves be reversed, stripes may be produced by the length of the cloth, displaying the colour of the weft by one set, and that of the warp by the other. On this principle is woven that species of cloth called dimity, all the variety of pattern arising from the different quantities of warp in the stripes.

Again, if two sets of treadles are also employed, with the cording of one set the reverse of the other, the whole may be woven into checks or alternate squares, such as Fig. 12. This is called turning or reversing the tweel, and is the principle on which all dornich, diaper, and damasks are woven.

Sect. V. *Dornich and Diaper.*

This branch of weaving is chiefly confined to the manufacture of table linen, though sometimes shawls are made on this principle, the warp and weft of which are of different colours. Dornich, which takes its name from Dornoch, in the north of Scotland, where considerable quantities are made, is only a coarser kind of diaper, and is usually distinguished by being woven with four leaves, while the five-leafed broken tweel is always employed for the genuine diaper.

The most simple pattern that is woven on this principle, is the damboard or checker, Fig. 12. already referred to. In this example it will be observed, that there are only two leaves and two treadles represented, with a portion of the warp, equivalent to one of the squares drawn alternately on each leaf. The two leaves thus marked, indicate that two sets of tweeling leaves are necessary for the pattern, and that the warp is to be drawn straight over each set where the marks are placed. That is to say, as there are five marks opposite to each square, whatever num-

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ber of leaves is in one set of the tweel, five times over the leaves of each set must be drawn, alternately, to produce the pattern. Hence it is customary, in making draughts and cordings for diaper patterns, to substitute one leaf only, for each set of tweeling leaves, and to place raising marks on their intersections with the treadles when the tweel is to be reversed. This abridged draught and cording is termed, by diaper weavers, the binding plan. The following scheme is an example of the damboard draught and cording in its extended form, adapted to the four-leafed regular tweel. The figures may be enlarged by repeating the draughts on each set.

No. 1. Damboard.

	0	0	0				0		1 1 1 1 1
0		0	0			0			2 2 2 2 2
0	0		0		0				3 3 3 3 3
0	0	0		0					4 4 4 4 4
			0		0	0	0	1 1 1 1 1	
		0		0		0	0	2 2 2 2 2	
	0			0	0		0	3 3 3 3 3	
0				0	0	0		4 4 4 4 4	
				4	3	2	1		
4	3	2	1						
	B				A				

Here it will be obvious, that as there are four times fives, or twenty threads of warp in each space, there must also be twenty threads of weft thrown in to make the spaces square; and therefore the weaver works five times over the treadles A, for one row of squares, and then five times over those at B, which forms another row, the reverse of the former. Were the same pattern to be woven with the diaper, or five-leafed satin tweel, the plan of its mounting would stand as below.

No. 2. Diaper Damboard.

0	0	0		0		0					11111
	0	0	0	0					0		22222
0	0		0	0			0				33333
0	0	0	0		0						44444
0		0	0	0				0			55555
	0				0	0	0		0	11111	
				0		0	0	0	0	22222	
		0			0	0		0	0	33333	
0					0	0	0	0		44444	
			0		0		0	0	0	55555	
					5	4	3	2	1		
5	4	3	2	1							

From these two examples, it will appear, that one draught of the tweel, or once over any set of tweeling leaves, will always correspond with one space of the design paper, and likewise with one mark on the binding plan. Particular attention, however, is necessary when making cording plans for turned tweeling, to avoid placing the raising marks of different sets or compartments close together where they join; for this would extend the flushing beyond its own compartment, and render the edges of the pattern rugged and ill defined; or, to use the technical phrase, the divisions would not *cut*.

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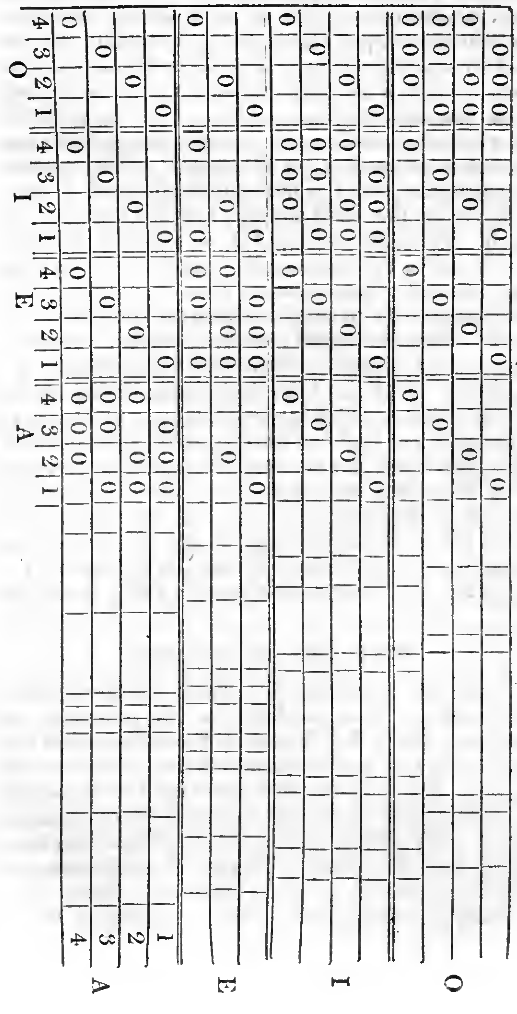
Now, an endless variety of pattern may be woven on this principle, by increasing the number of sets of the tweel, and diversifying the arrangement of the draught upon the leaves. We shall add an example of four sets or divisions, under two different forms, by which the general principle will more easily appear; but first it will be necessary to insert the binding plan, which will exhibit the succession of the draught.

No. 3. See Fig. 13. Plate 48.

o	i	e	a										
0						1	2		2	1			o
	0				1	1	2		2	1	1		i
		0		1		1	3	3		1	1		e
			0	1		1	4		1			1	a
	1	1	1										
1	1	1	1										
2	2	3	4										
2		3											
		&c											



No. 4. Full Mounting. Fig. 13.

In the plan No. 3. the units of the figures on the leaves *a*, *e*, *i*, *o*, denote separate draughts over the corresponding sets of leaves A, E, I, O, of the full mounting No. 4.; and these are represented by lines crossing each set or division, which indicate, that the threads of warp are drawn, whenever they are marked, in the order of the figures 1, 2, 3, 4, at A. The raising marks on the binding plan also shew when the tweel is to be reversed; and this is effected by placing the greatest number of raising marks on the corresponding squares of the full mounting.

The order of treading these patterns is generally the same as that of the draught, a portion of which is marked on the treadles of No. 3. though other patterns will be produced by a different order. In weaving the pattern Fig. 13. of which No. 4. is the mounting, the weaver works once over the treadles A, in the order 1, 2, 3, 4; then once over the treadles E, once over I, once over O; then returns in the same order: and when he comes to 2, 3, or 4, marked on the plan of treading, he works likewise two, three, or four times over the corresponding set of treadles. Hence it is evident, that as long as he works, for example, on the treadles A, those parts of the pattern which are woven by the leaves E, I, O, will shew by the weft, and such as are woven by the leaves A will appear by the warp; and so of any other pattern on this principle.

In the pattern we have been describing there is only one set of the tweel reversed; but this is merely discretionary, for any number of sets may be raised or sunk, according to the extent of the mounting or diversity of pattern required. Fig. 14. is woven by the preceding draught, but with two sets of the tweel reversed. The following is a plan of the cording.

No. 5. Fig. 14.

		0	0	1 2 2 1
0			0	1 1 2 2 1 1
0	0			1 1 3 3 1 1
	0	0		1 1 4 1 1

1	1	1	1
2	1	1	1
2	2	3	4
1	2	3	1
	1	1	1
	1	1	

No. 6. Full Ending. Fig. 14.

0				0				0	0	0		0	0	0	
	0				0			0	0		0	0	0		0
		0				0		0		0	0	0		0	0
			0				0		0	0	0		0	0	0
0	0	0		0				0				0	0	0	
0	0		0		0				0			0	0		0
0		0	0			0				0		0		0	0
	0	0	0				0				0		0	0	0
0	0	0		0	0	0		0				0			
0	0		0	0	0		0		0				0		
0		0	0	0		0	0			0				0	
	0	0	0		0	0	0				0				0
0				0	0	0		0	0	0		0			
	0			0	0		0	0	0		0		0		
		0		0		0	0	0		0	0			0	
			0		0	0	0		0	0	0				0
4	3	2	1	4	3	2	1	4	3	2	1	4	3	2	1

These examples are adapted to the common method of weaving with the full complement of treadles; but when the mountings become extensive, recourse must be had to other expedients. The principle of the diaper-mounting, properly so called, has been explained in Part II. Chap. II. Sect 2. And when the range of pattern is still too large for this apparatus, it is usually woven in the back-harness, which is an intermediate mounting between this and the draw-loom. The principle of the back-harness has also been fully illustrated in Chap. II. of Part II. Sect 5.; and it is only necessary to observe, that the draught of the binding plan which has been here described, is adapted to the back or harness leaves of that apparatus, each unit corresponding to one mail or eye, one set of the tweel being drawn through each.

Sect. VI. *Damask.*

This beautiful branch of weaving is extensively applied in the manufacture of the finest kinds of table linen. It also forms a part of the silk and cotton manufactures, and produces some of our richest shawls, plaids, and other species of ornamental dress.

Damask is merely an extension of the principle of diaper, by means of the draw-loom. The damask harness is generally of that kind denominated a pressure; having, as formerly observed, three, four, five, and even eight threads in each mail: for although it would add greatly to the value of damasks to weave them in a full harness, yet the range of pattern is often so large, that a mounting of this kind becomes extremely expensive.

The process of weaving damask will be very easily understood by referring to Chap. II. Sect. 5. of Part II.; for the sheds are formed exactly in the same man-

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ner as those of the back-harness. Fig. 15. Plate 48. is a pattern on a small scale, adapted to the damask-mounting. If we suppose five threads to be drawn through each mail, each space of the design paper will also denote five threads: and, as the tweel is supposed to be that of eight leaves, when the mails corresponding to the spaces marked on the design are raised by the draw boy, the weaver works over his treadles, each of which raises one leaf and sinks another; and, consequently, every eighth thread of the ground is raised, and the same proportion of the figure sunk; by which the weft will predominate on the upper side of the ground and under side of the pattern. The following plan will shew the connection between the front leaves and treadles. The cyphers, as usual, denote raising cords, and the crosses, ×, sinking ones; the blank squares indicating that no connections are necessary, or that their leaves are stationary.

No. 7.

×						0		1
			0		+			2
0		×						3
					0		×	4
		0						5
	×						0	6
				0		×		7
	0		×					8
1	2	3	4	5	6	7	8	

In the mounting of damask looms there is frequently some little economy observed that is not customary in the other branches of weaving, by combining what is called single and double mounting. The single mounting is the same as any other harness tied in separate parts, one mail of each part being attached to each simple cord; but in the double mounting two mails are connected to each simple, except at the centre, where there is only one, from which the others diverge on each side, as from a central point; double mounting will therefore produce a pattern similar on each side, after the manner of a gathered harness, though frequently there are a few designs single in the central points, which gives still a further diversity to the figures. This will be better understood by consulting Fig. 1. Plate 47.

Chap. III. Flushing.

This is another species of weaving, which is variously applied in the different branches of our manufactures. Like tweeling, it is effected by passing portions of the weft over or under the warp, without their being incorporated, but at certain intervals. Tweels, however, from the regularity of their intervals, are chiefly confined to the production of grounds, or, by combining a greater quantity of materials in a given space, to increase their durability; whereas, the flushing here meant is always employed for ornament.

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Sect. I. *Lined Work.*

This is also almost exclusively confined in Scotland to the manufacture of table-linen. Its patterns, like those of fancy-tweeling, are produced by raising various portions of the warp and weft, alternately, to the same side of the cloth; but instead of running obliquely across, they in general assume the form of squares, which is effected by drawing the warp first straight over the leaves, then back alternately, and working over the treadles in the same zig-zag order. Patterns of this kind woven in mountings below eight leaves are usually denominated bird-eyes; but when they extend to eight and upwards, they are called lined work, probably from the general tendency they have to run in lines.

In Fig. 11. Plate 48. will be found a specimen of the bird-eye, woven with five leaves. One set of the draught, it will appear, runs straight over the leaves and back; and by the repetition of this draught, and working the treadles over in the same order, the cloth assumes the appearance represented on the design paper. Fig 16. is a lined-work pattern of greater extent, and will serve to illustrate the general principles. It requires 12 leaves and the same number of treadles, and the draught and treading follow the same order as the preceding. The variety produced by these mountings arises principally from the different arrangement of the raising and sinking cords; and, when the mounting is extensive a beautiful diversity of patterns may be formed, by the combination of plain, tweeled, and flushed texture, as we frequently observe in some of the fine figured sarsenets. The following plan is the draught and cording of Fig. 16.

No. 8. *Fig.* 16. *Plate* 48.

			0	0	0					0	0		1
			0	0					0	0	0	22	2
			0		0	0	0	0	0	0		21	3
0	0	0			0	0	0	0	0			20	4
0	0				0	0	0	0			0	19	5
0		0	0	0	0	0	0		0			18	6
		0	0	0	0	0				0		17	7
		0	0	0	0		0					16	8
		0	0	0				0				15	9
	0	0	0		0				0			14	10
0	0	0				0				0		13	11
0	0			0			0				0	12	
12	11 13	10 14	9 15	8 16	7 17	6 18	5 19	4 20	3 21	2 22	1		

Lined work patterns are susceptible of still greater variety, by a different arrangement of the draught and order of treading. We can add only one example more, to shew the principle on which such variety may be produced; and its effect may be easily seen by tracing it on design paper.

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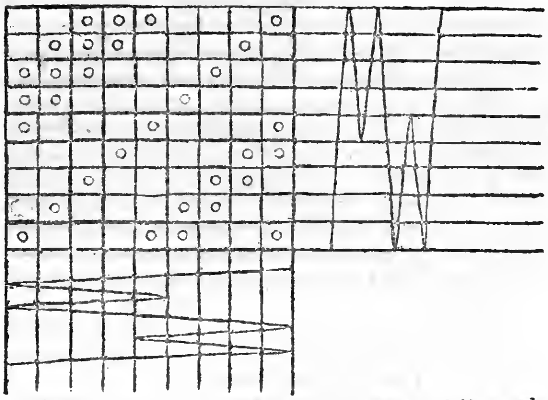
No. 9. Lined Work.



Here the weaver, in drawing his warp, follows the line which crosses the leaves, and in treading he observes the very same order.

Sect. II. *Dumb Flowers.*

This is a species of embellishment, the patterns of which are produced by forming little spots or figures by flushing the weft over the warp, while the ground is woven either plain or tweeled. These figures are very common on cambric grounds, and also on cotton shawls or gown pieces, the warp and weft of which are of different colours. The principle, however, will be better understood by examples.

No. 10. Fig. 17. Plate 48.

					0			0	0	53
		0	0	0						64
					0		0	0	0	7 1
	0	0	0	0						8 2
					0	0	0			53
0				0						64
					0	0	0		0	7 1
0			0	0					0	8 2
					0	0	0	0	0	1 31 1 C
0	0	0	0	0						2 42 2 D
4 6	2 8	4 6	2 8	B	A	3 5	1 7	3 5	1 7	

No. 11. Fig. 18. Plate 48.

				0	0	0		31 31
				0	0		0	31 31
				0	0	0		31 31
				0		0		31
				0	0	0	0	31 31 C
	0	0	0					42 42
0		0	0					42 42
	0	0	0					42 42
	0		0					42
0	0	0	0					42 42 D
8	4 12	2 6 10	B	A	1 5 9	3 11	7	

In No. 10. A and B, are the plain or ground treadles, and C, D, the ground-leaves. One set of the pattern contains 12 splits, four of which are drawn on the plain leaves, and four on each of the sets of spotting leaves; as there is, in this example, one row of spots thrown into the bosom of the other. The figures on the treadles point out the succession of treading, but, to complete the figure, each set must be wrought over twice. In this mounting, also, the leaves on which the odd threads are drawn are placed alternately with those of the even numbers; but in the plan No. 11. they are separated, which divides the mounting into two equal parts, which have the effect of plain leaves when they work against each other.

Sect. III. *Corduroys, Velvets, &c.*

In this, as in some of the other species of fancy-weaving, considerable ingenuity is displayed in the production of patterns, which, in general, exhibit a variety of flushing peculiar to themselves. The ground, or back, as it is usually termed, is sometimes plain and sometimes tweeled. In the former case it is denominated tabby or plain back, and in the latter Jean or Genoa; and the Jeans are single or double, according as they are woven with a three or four-leafed tweel. The weft that forms the flushing, and which is afterwards cut up to constitute the ridges, is the same as that of the ground, but is thrown in and interwoven with it at various intervals; and on this depends all that diversity of patterns which we see in these fabrics. The following examples will give the reader some idea of this species of manufacture.

Thickset Cords, Tabby back.

No. 12.

				0	5 3 1
	0	0			4 2
0			0	0	9 7
	0				10 8 6
6	4	2 5	3	1	

No. 13.

0			0	0	3 1
				0	5
	0				2
	0	0			6 4
6	4	2 5	3	1	

In these examples it will appear, that of every six shots of weft that are thrown in, only two are appropriated to the ground, the other four being flushed. The flushing shots are distinguished by having only one raising mark on each treadle, while those of the ground have two.

Velvets.

Plain back. No. 14.

				0	3 1
		0		0	5
0	0		0		2
	0				6 4
6	4	2 5	3	1	

Jean back. No. 15.

	0			0		4 1
	0				0	5 2
0			0	0	0	6
		0		0	0	3
8 12	6 14	4 7 10 13 16	2 5 15	3 11	1 9	

In No. 15. if the treadles on which the figures 1, 3, 6, are placed be wrought over in succession, they will be found to produce the three-leafed tweel; for,

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by the peculiar management of the draught and cording, two sets of the tweel, which amount to six threads, are contained on four leaves only. The flushing is produced by those treadles on which is only one mark. We shall add a few of the principal varieties, without troubling the reader with further remarks.

Tabby back. *No.* 16. — *Velveteens.* — *Jean back.* *No.* 17.

					0	1	0				0		1
0			0			2		0			0	0	2
					0	3	0					0	3
		0	0	0		4	0		0		0		4
					0	5					0	0	5
	0		0			6	0			0		0	6
4	2	7	5	3	1		7	5	3	2	4	1	
8	6							9	8	6			

Double Jean Cords.

No. 18. — *No.* 19.

	0			0		5 1	0	0					1
				0	0	6 2		0			0		2
0					0	3	0					0	7 3
0	0					4					0	0	8 4
0			0		0	7		0	0	0			5
0	0	0				8		0		0	0		6
8	6	4	2	3	1		8	6	4	2	3	1	
		7	5						7	5			
		10	9						10	9			

A seven-shaft Cord.
No. 20.

	0			0		7 1
				0	0	8 2
	0				0	12 9 6 3
0	0		0	0		4
0			0	0	0	11
		0		0	0	5
	0	0		0		10
8	6	4	2	3	1	
12	14	7	5	11	9	
		10	15			
			13			
			16			
			17			

An eight-shaft Cord.
No. 21.

0	0					9 1
	0			0		10 2
0	0	0				5
0		0			0	12
	0		0	0		6
			0	0	0	11
				0	0	7 3
0					0	8 4
8	6	4	2	3	1	
		7	5			
		10	9			
		12	11			

New Imperial Cord.
No 22.

	0			0		14 10 6 2
0	0				0	13 9 5 1
		0		0	0	3
0			0		0	4
0		0			0	12
			0	0	0	11
				0	0	15 7
0					0	16 8
8	6	4	2	3	1	
		7	5			
		10	9			
		12	11			

Sect. IV. *Flushed Stripes and Borders.*

This species of flushing differs considerably from any of the preceding, in so much that the figures here are formed by raising and sinking certain portions of supernumerary warp and weft above and below the ground, at such intervals as will form the pattern. This superadded warp or weft is usually of different colours from the ground or body of the web; and the pattern is sometimes produced with leaves, and sometimes it is extended to the draw-loom. We shall insert a few examples to shew the general principle.

Flushed Stripe.
No. 23.

		0	0	1 1 1 . 1 1 1
		0	0	3 3 3 .3 3 3
0	0			2 2 2 . 2 2 2
0	0			4 4 4 . 4 4 4
	0		0	| | | | | | A
	2		1	
	4		3	Flushing above.
	6		5	
8		7		
10		9		Flushing below.
12		11		
d	b	c	a	

In this example there is only one leaf for the flushing warp, which is raised above the ground so long as the weaver works on the treadles *a*, *b*; but sunk below it by the treadles *c*, *d*. The threads of flushing, which are generally double yarn, are drawn on the leaf A, and one thread goes into an interval of the reed along with a splitful of the ground.

Flush Spot.
No. 24.

				0	0	0	0	1 1 1 1 1 1
				0	0	0	0	3 3 3 3 3 3
0	0	0	0					2 2 2 2 2 2
0	0	0	0					4 4 4 .4 4 .4.
0	0	0			0	0	0	. | | . .
0	0					0	0	. | | .
0							0	| |
			B	A				
6	4	2			1	3	5	
8	10	12			11	9	7	

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It will be observed here, that the ground is woven by the plain treadles A, B, with the flush-warp below; but when the spotting treadles are wrought over in the order of the figures, the flush warp is raised above the ground, and forms the figure, which is a round drop.

In weaving checks or borders on this principle, the ground-leaves must be so constructed as to form the same figure across the body of the web, as is produced on the stripe. No. 23. woven as a check, will serve for an example.

Flushed Check or Border.
No. 25.

0	0			0	0	5 3 1 5 3 1
				0	0	5 3 1 5 3 1
0	0	0	0			6 4 2 6 4 2
		0	0			6 4 2 6 4 2
0			0		0	
		4	2	3	1	A
2 4			3		1	B
	2 4	3		1		C

The treading at A is for the stripe; six shots on the treadles 1, 2, and six on 3, 4, complete the pattern. At B, the treading is repeated three times, a shot of the ground, and a shot of the flush weft being thrown across alternately; and the treading at C is exactly the same, but the flushing reversed.

Chap. IV. Spotting.

Under this head we shall comprise all those species of ornamental weaving, the decorations or embellishment of which are produced by interweaving portions of supernumerary warp or weft with the ground; the flushed parts being generally cut away. Of these there is an extensive variety, the principal of which we shall explain in their order.

Sect. I. *Common Spots.*

The mounting of a common spot consists of a front leaf, a ground leaf, and the leaves appropriated to form the figures. If the threads of warp were numbered from the right side of the mounting towards the left, as formerly observed, all the odd numbers 1, 3, 5, &c. would be drawn on the ground and spotting leaves, and the even numbers on the front leaf. Hence, plain cloth is produced by working the front leaf against all the others; the spotting leaves being only raised independently of the ground when the spotting weft is thrown across. When no plain spaces intervene between the spots, the ground leaf is superfluous, except for a few splits at each side for selvages; and patterns of this description are denominated all-over spots.

The draughts of spots are of various forms; some run straight over the leaves as in tweels, and others resemble those of lined work, in running straight over the leaves and returning in the same order. Indeed, the forms which these draughts might be made to assume, are endless; but we shall confine ourselves to the description of the two here mentioned, as they are of most general use.

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Common Spot. Fig. 19. *Plate* 48.
No. 26.

	0					0	1
	0				0	0	2
	0			0	0	0	3
	0		0	0	0	0	4
	0	0	0	0	0	0	5
	0						C
0							D
B	A	1	2	3	4	6	
					5	7	
		11	10		9	8	
		12					

Here the treadles A, B, are for the ground, and the others for weaving the spot. C, and D, are the ground and front leaves, and 1, 2, 3, 4, 5, the leaves for weaving the spot. This figure stands upon ten splits of the reed, and an equal number of splits are woven plain, five of which are placed on each side of the spot draught; hence, such patterns are said to be half cover. The plan of cording, and the figures pointing out the succession of treading, compared with Fig 19. Plate 48. will render the whole perfectly plain. It is to be observed, however, that in all spots or harnesses woven on this principle, two shots of the ground must be thrown in for each shot of the spotting weft, in order to reverse the spotting sheds. The same remarks will equally apply to the following plan.

Common Spot. Fig. 20.
No. 27.

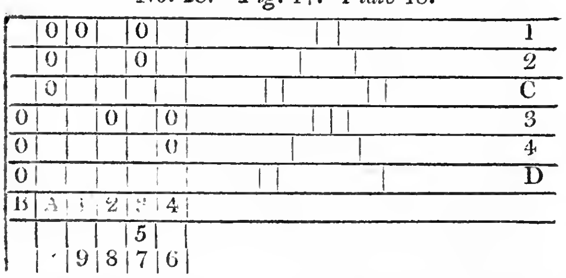
	0			0	0							
	0		0	0	0	0						0
	0	0	0	0	0	0	0					0
	0	0	0	0	0	0	0	0			0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	
	0		0	0	0	0	0	0	0	0	0	
	0		0	0	0	0	0	0	0	0		
	0			0	0	0	0	0	0			
	0				0	0	0	0				
	0											
0												
B	A	1	2	3	5	7	8	9	10	12	13	14
				4	6				11			

Draw-loom. If we now suppose the draught of No. 27. to be extended to 100, or 150 splits, for example, instead of ten, it will be evident that we could not with convenience employ either 100 or 150 leaves, with a proportionate number of treadles; and hence the expedient of adopting the draw-loom, when all that assemblage of timber mounting is superseded. The common spot draw-loom, therefore, requires only one half of a full harness, the odd threads being drawn through the mails, and the even ones between them. In front of the harness, however, are four plain leaves for weaving the ground. These leaves are necessary on account of the harness having no alternate motion for raising and sinking the warp, except what is communicated by the simple; and likewise, because only one half of the warp is in the harness. Each thread of the warp is drawn through a heddle on two leaves; first, below the clasp of a heddle on one leaf, and, again, above the clasp of a heddle on the other, so that both leaves are thus requisite to produce the effect of one. This is the method generally adopted in those draw-looms which do not require the long-eyed heddles, to permit the warp to rise in forming the spotting sheds; for that leaf, into the under part of which the warp is drawn, is raised by a treadle at each lift of the harness. In these leaves, the doups through which the threads are drawn, are made a little longer than the others, so as to form spaces similar to the eyes of other heddles, to allow the warp to pass easily through them.

Sect. II. *Paper Spots and Brocades.*

In the common spot, two shots of the ground are always necessary for each shot of spotting, in order to reverse the spotting sheds, which prevents the figures from having that rich and solid appearance which is so very desirable in fine fabrics. To obviate this inconvenience, another method has been invented, by which the spotting is sufficiently bound by one shot of the ground; and which, from the closeness of the texture produced, is called a paper spot. This is effected by drawing that half of the warp which occupies the front leaf of a common spot on a correspondent set of spotting leaves, and forming the spotting sheds, alternately, by the back and front sets. The advantage of these mountings is not only conspicuous by the close texture of their figures, but they afford facilities for flushing or tweeling the patterns in such a manner as to produce that beautiful variety of ornament called brocades. As paper spot patterns, however, are generally too extensive to be woven with treadles, recourse is usually had to the machine called the parrot, or some of those described in the first part; and, therefore, instead of draught and cording, the pattern is usually given to the weaver on design paper. We shall, however, insert the plan of a paper spot mounting on a small scale, to shew the principle; after which we shall explain the method of applying the machine.

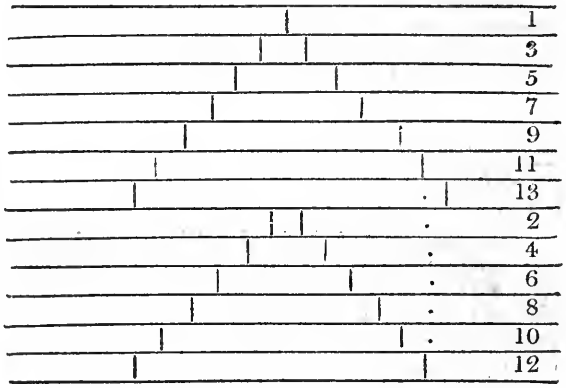
Paper Spot.
No. 28. *Fig.* 17. *Plate* 48.



In this plan, C, D, are two leaves for the ground or plain parts, and the leaves 1, 2, are the same as would have produced the pattern on the common spot principle. The leaves 3, 4, are therefore added to reverse the spotting warp for the plain sheds. A, B, are the plain treadles; and the figures, as usual, point out the succession of treading exclusive of the ground.

Fig. 21. Plate 48. is a brocade spot, though generally termed a paper spot. It requires thirteen spotting leaves, exclusive of the ground; the draught of which is below, and which is the most common form of these mountings. We may here add, that when one row of these, or any other kinds of spots is thrown into the bosom of the other, as in Fig. 17. another set of spotting leaves must be added for that purpose.

Brocade Draught.
No. 29. *Fig.* 21.



The natural form of these mountings is in the order of the figures 1, 2, 3, 4, but the odd and even numbers are here separated, as they are raised alternately in forming the plain sheds. Sometimes, however, the ground is woven by a set of plain heddles in front, like those of the draw-loom, in which case the leaves assume their natural order.

To read the pattern, Fig. 21. Plate 48. on the machine, Fig. 1. Plate 46. we commence at the centre space of the spot, and supposing the other spaces numbered from the centre, either to the right or left, corresponding to the leaves in the preceding draught, we connect the coupers of the leaves 1 and 2, to the bead or knot on the right side of the machine, for the first spotting shot. As all the dark shaded spaces in the pattern are omitted for the tweel, we pass over the centre leaf, or 1, and attach the second leaf, only, to the second bead. For the third shot, we take number 1, pass 2, take 3, 4, 5, 6, and connect them to the third bead; and so on, till the whole is gone over; connecting none but the leaves which are represented by the light shaded spaces.

If what has been said with respect to the common spot harness, be well understood, it will evidently appear that this species of spotting requires a full harness, with a set of plain leaves, in like manner, for the ground. The patterns are usually designed by making each space on the paper represent a single thread, though sometimes they are read from a common spot pattern; but this requires some attention

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to prevent a kind of ruggedness on the edges of the figures, which is known among tradesmen by the name of teething.

SECT. III. *Spots on Tweeled Grounds.*

When spots are woven on tweeled grounds, the spot mounting is exactly the same as that of the paper spot, with a set of tweeling instead of plain leaves in front for the ground. But the great proportion of this species of spotting is woven in the draw-loom, by which the most extensive variety of full and pressure shawls, plaids, garments, &c. are produced, in imitation of these costly articles which are imported from India. The harnesses for this branch of weaving are of different constructions, according to the richness of the pattern or the form of the piece to be woven. The relation between these mountings, however, will be easier understood, by bringing those which are in general use into one point of view. The principal species are, the full harness, the split, or two-thread harness, the three-thread harness, and the four-thread harness; all of which, except the first, are called pressures, on account of the front-leaves opening the flowering sheds after part of the warp has been raised by the harness, as in weaving damask.

Suppose the sprig, Fig. 1. Plate 49. to be woven by each of the preceding harnesses, then Figs. 2. 3. 4. and 5. would be designs for the 4, 3, 2, thread, and full harness, respectively. Hence, in the four-thread harness there are four threads in each mail; and these are represented by one space on the design paper. The same is to be observed of the others; by which it is evident, that the full harness makes the pattern the most perfect; but the more threads in each mail, the fewer mails and corresponding cordage will be requisite to work the pattern, and, consequently, can be mounted at a proportionably cheaper rate.

With respect to the full harness, after the warp is taken through the mails, one thread in each, the whole is again drawn into a set of tweeling heddles, generally a four-leafed tweel. As the threads, however, are first drawn below the clasps of the heddles of one leaf, and again above those of another, eight leaves will be necessary to open the four-tweeling sheds, the spotting sheds being formed directly by the harness. In weaving these patterns, which are usually called imitations, one shot of the ground is thrown in alternately with a shot of the spotting, except where there is double, triple, &c. shotting; and the treadles are wrought over in the order of a regular tweel. As all the tweeling, or flushing, in the figured parts are effected by this harness, the black or dark shaded spaces are omitted in reading such patterns on the simple, as will appear in Fig. 5.

Pressure-spotting is woven by first raising portions of the warp by the simples, and afterwards opening the spotting-shed by the front leaves, into which a shot of spotting is thrown. The simples are then relieved while the weaver throws in a shot of the ground. The same simples are drawn a second, third, or fourth time, according as it is a split, three, or four-thread harness; and a shot of spotting and one of fine thrown in alternately; after which a new set of lashes is drawn in the same manner. The following plans will shew the connections of the front leaves and treadles for a four-leafed tweel.

No. 30. *No.* 31.

	0			0		0	0	1	0	0	0		0			0
		0		0	0		0	2	0		0			0	0	0
0		0	0		0			3	0			0	0	0	0	
0	0		0			0		4		0	0	0	0		0	
	4		3		2		1	A		4		3		2		1
4		3		2		1		B	4		3		2		1	

Note.—The treading opposite to A is for the spotting, that opposite to B for the ground.

SECT. IV. *Seeding.*

In this species of ornamental weaving, the figures are formed by raising a number of coarse warp-threads above the surface of the cloth, by a mounting similar to that of the common spot, and forming them into small loops by means of cords, or more frequently wires run into the sheds. In the former case, the weaver throws across a shuttle, to which a cord is attached somewhat longer than the breadth of the web. This cord is allowed to remain until as much of the ground is woven as will fasten the seeding warp in the cloth, or sometimes till two or three successive cords are thrown in, after which they are drawn out in order, as they are again wanted. When wires are used, there is a small piece for each spot in the breadth of the web, fixed in the edge of a board, and which are all bent at right angles and polished, so that each may run freely into the shed of its respective spot. All these wires are drawn out by the weaver's thumb, and are placed in a notch in the board, when he has woven as many shots as will fasten the seeding, and then they are ready to be introduced into the succeeding spottingshed.

Hence it is evident, that as the seeding-warp is thus raised into loops above the cloth, it requires to be considerably longer than that of the ground, and also must be wound on a separate roll, that it may yield occasionally to the cords or wires when they are introduced to form the loops. And it further appears, that when more than one leaf is requisite for the pattern, if any part of the seeding-warp were thus drawn up to form the seeds, the remaining part would become slack were it all upon one roll; and therefore, whatever portion of the yarn is to be drawn on each spotting-leaf, must be wound on a separate roll by itself.

Notwithstanding the great numbers of rolls thus requisite for an extensive pattern, this species of weaving has likeways been extended to the draw-loom. As each thread of the seeding-warp in one part of the harness must rise independently of the others, and consequently requires a separate roll; to save room, each thread is wound upon a small bobbin, and placed in a frame similar to the bank of a warping-mill, which stands in the treadle-pit below the warp-roll. As it would be impracticable to apply a weight or pace to each bobbin, the threads, after passing through a ravel, to keep them at a proper distance from each other, are secured between two pieces of wood, which are pressed together, and pla-

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ced across the loom, a little below the warp. On each thread is suspended a small piece of lead, which keeps it at the requisite degree of tension, and sinks it a considerable way into the treadle-pit. These threads are again raised nearly to a level with the main warp, by passing over a roller at a small distance from the back of the harness. The weaver proceeds in the same manner as above described, but the harness is usually raised by a draw-boy, or one of the machines formerly employed. Indeed, from the great number of lifts which are frequent in seeding patterns, the machine is commonly employed even for such as are woven with leaves.

Plush, Velvet, and Shag.—Though these fabrics do not appear to come with propriety under this head, yet the process by which they are woven is so very similar to that of seeding, that the latter seems evidently to have been derived from it. These webs consist of two warps, which are denominated the main warp or ground, and the pile warp. The ground is commonly of hard silk, and the pile is sometimes of silk less twisted, and sometimes of goat's hair spun into threads. The pile is wound on a separate roll from the ground, and is mounted with leaves and treadles, by which it is occasionally incorporated with the main warp, and at other turns raised entirely free of it. When the weaver has woven the heading or end of his piece, he raises the pile warp above the ground, and introduces a flat brass wire, which is longer than the breadth of the piece, and which has a very fine groove cut in one of its edges; he works a few shots, which incorporate the ground or pile, raises the pile again and introduces another wire of the same kind, weaves a few shots, inserts a third wire, and weaves a few shots. He now takes a sharp pointed instrument called a truvat, and runs the point along the groove of the wire first introduced, which relieves it, and leaves the ends of the pile projecting from the cloth, and forming the shag. The wire which is thus relieved is inserted into the next shed and a few shots woven, and so on as already described. The pile is afterwards cut smooth with a pair of shears.

Sect. V. *Cut Stripes.*

This is a species of fancy weaving, which has a great resemblanee to the common spot. In cut stripes, however, the figures are formed by supernumerary warp, interwoven with the ground at certain intervals; whereas similar figures are formed, on the common spot principle, by throwing across spotting weft. We shall select, for an example, the mounting No. 26. referring to Fig. 19. Plate 48. for the figure of the pattern.

Cut Stripe.

No. 32. *Fig.* 19.

						0
					0	0
				0	0	0
			0	0	0	0
		0	0	0	0	0
	0	0	0	0	0	0
0						
B	A					
2		1	3	5	7	11
4					9	13
6						
8						15
10		21	19		17	
12		23				
14						
16						
18						
20						
22						
24						

Here the two treadles A, B, weave plain cloth with all the striping warp sunk below the ground; but when the spotting treadles are woven alternately with the treadle B, in the order of the figures, the spot Fig. 19. will be produced; and whatever part of the striping warp is left out by weaving with the two plain treadles, is afterwards cut away.

Chap. V. Double Cloth.

Sect. I.

Plain double cloth, as its name imports, consists of two distinct warps, which are either woven separately, except at the selvages, where they are united by the weft, or by throwing in two or more separate wefts, and raising certain portions of one web above the other at such intervals as will produce a diversity of pattern. The first of these methods is adapted to the weaving of pillow-cases, patent lamp wicks, and those pipes which have lately been attached, in France, to the fire-engine. The last is the method chiefly pursued in the quilting and carpet manufactures.

The fabrics which usually compose double cloth, are either the plain or tweeled texture. When the texture is plain, two sets of plain mounting will only be necessary; but if tweeled, two sets of mounting peculiar to the tweel adopted must be applied. The following little plan will fully illustrate the principle of double cloth weaving.

Double Cloth.
No. 33.

	0						0		0	0			0	5 1 Blue
0						0			0	0			0	7 3 Blue
				0		0	0			0		0		6 2 White
			0			0	0		0			0		8 4 White
2	1		4	3		6	5		8	7		10	9	

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In this example, the warp of one web is supposed blue and the other white: consequently the threads of blue warp are distinguished by the odd numbers on the draught. Hence it is easy to perceive, that by working on the two treadles, 1, 2, the blue warp only will be woven into cloth, the white warp being sunk all the while below. Again, if the treadles 3 and 4 be wrought alternately, the white warp will be wrought into cloth, while the blue warp is thrown to the under side. The treadles 5 and 6 make the blue warp into cloth, with the white above; and 7 and 8, make the white into cloth with the blue above. The treadles 9 and 10 form the whole of the warp into one solid mass of plain texture.

Hence it is evident, that if the two sets of treadles 1, 2, and 7, 8, are wrought over in the order 1, 7, 2, 8, and a shot of blue weft thrown into the blue web, and a shot of white into the white one alternately, we shall have two distinct webs woven at the same time, the blue cloth above the white. And also, were the other two sets of treadles 3, 4, 5, 6, wrought over in the succession 5, 3, 6, 4, the very same effect would be produced, except that the white warp would now be uppermost. If, therefore, we were to work for any determinate time on either of these sets of treadles, we should still produce two distinct fabrics, either of which may be raised above the other at pleasure; by which blue and white stripes would be formed, running from one side of the cloth to the other. Again, were both warps of one colour and one kind of weft thrown in, the two webs would be formed into one piece, united by the weft at the selvages, and forming a kind of bag without any lateral seam. But when we would form checkers or alternate squares by double cloth, we must adopt a mounting of the following form.

Damboard, Double Cloth.
No. 34. Fig. 12. Plate 48.

			0	0		0	0	5	1	Blue
	0			0	0	0		7	3	Blue
	0	0	0			0		6	2	White
0	0		0	0				8	4	White
0		0	0				0	5	1	Blue
0	0	0			0			7	3	Blue
		0			0	0	0	6	2	White
0				0	0		0	8	4	White
4	3	2	1	4	3	2	1			
		A				B				

Here we have two sets of double cloth mounting; and portions of the warp, which ought to be equal to the extent of the squares drawn alternately on each set. The four treadles at A work the white warp on the back set of leaves uppermost, and on the front set below; and the treadles at B reverse this process, thus producing the changes requisite for the checker. In the same manner we might weave the diaper pattern, Fig. 14. Plate 48. on the double cloth principle, which would be effected, merely by substituting four sets of double cloth mounting for the four sets of tweeling, and applying the raising and sinking cords, as in the precedingexample.

Sect. II. *Quiltings.*

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Marseilles, or quiltings, are a species of goods manufactured in considerable quantities in England, and printed, chiefly for vest pieces. The mounting of a marseille consists of a set of plain heddles for the face, or finest fabric, and a number of stitching leaves, adapted to the range of pattern, for the back; and these last produce all the variety in the design. The most prevalent patterns on these goods, are the oblique or biased stripe, and the diamond or lozenge figures; although they are susceptible of almost every diversity that arises from the arrangement of the draught, or succession of working over the treadles.

The warp and weft of the face are considerably finer than those of the back; and two threads of the former and one of the latter are drawn through each interval of the reed. Thus, for instance, if we were to make a marseille, woven in a No. 36 reed, or 36 beers in $24\frac{1}{2}$ inches, we might take No. 36 cotton yarn for the warp of the face, and No. 26 for the warp of the back. Also, we might make the weft of the face No. 46, and that of the back 36; and these numbers would produce a pretty good fabric. One example, which is that of a small biased stripe, will be sufficient to illustrate the principle of this species of weaving.

Biased Quilt.
No. 34.

		0		0			
0					0		
		0				0	
0							0
0	0	0	0				
0		0	0	0	0	0	0
8	2	4	3	13	9	5	1
16	6	12	7				
	10		11				
	14		15				

In weaving these fabrics, there are two shots of fine weft, and two of coarse thrown in alternately. One shot of the fine stitches the back and face together, and one shot of the coarse is thrown in between the back and face, perfectly clear of them both; and this is termed wadding. The other coarse shot is thrown into one of the sheds that constitute the back, so that when eight shots have been woven, four of them are appropriated to the face, two go for wadding, and two are thrown into the alternate sheds of the back. Upon this principle, extended to the draw-loom, are woven a great variety of very handsome bed-covers, the process of which must appear very simple, if what we have already advanced be well understood.

Sect. III. *Carpets.*

The carpets which are woven on the double cloth principle, are composed of two equal fabrics, usually plain texture, the warps of which are of different colours, and frequently in stripes, and the one is raised above the other where the pattern is to be formed.

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Hence, the pattern of a carpet will be the same on both sides of the cloth, with the colours reversed.

Carpets are, in general, manufactured of three sets or degrees of fineness. The superfine is woven in a $13\frac{1}{2}$ porter reed; that is, $13\frac{1}{2}$ porters, or 270 splits in 36 inches. The second, or fine, which is the most common, is woven in a 10 porter, and the coarse in a 9; and each of these three sets has four threads, two of each web, in one interval of the reed. The warps are all made of double yarn, and twisted; the weft single, but very coarse. The warp of a $13\frac{1}{2}$ porter may be about 3 lbs. per spyndle, single, which consequently will make it 6 lbs. in the double state. The weft is about 17 lbs. per spyndle. For the 10 porter, the warp will be about 7 lbs. double, the weft 20; and proportionally for the 9 porter. This, however, is the weight of the yarn in the grey state, as it comes from the mill; but after scouring, &c. it will be considerably finer. The warp of the 10 porter, for instance, when scoured and dyed, will be reduced to between 5 and 6 lbs., and the weft sometimes to 15; but this will, in some measure, depend on the cleanness of the yarn.

In designing patterns for carpets, one space of the design paper represents two threads, one of the ground and one of the figure. The pattern is read on the harness, by taking all the flower, and missing the ground, for one shot, and taking the ground and missing the flower for another, alternately. In the old method of weaving carpets, the harness sheds were all opened by a draw-boy. The lashes were connected directly to the tail, without simples; and at their lower extremities were attached small bobs or handles, similar to those employed in the diaper loom. These handles were suspended in pairs, one for each warp; and the whole were so arranged at the side of the loom, that the draw-boy could pull them in regular succession. When the warp of the ground or flower was thus raised by the harness, the sheds were afterwards opened by leaves of long-eyed heddles in front, as in the damask loom.

Carpets are now, however, generally woven with a machine, invented or improved by a Mr Morton, of Kilmarnock, which entirely supersedes the use of a draw-boy. This machine consists of a large cylinder placed above the loom, with the lifts of the harness agreeably to any pattern formed on its cylindric surface, after the manner of a tune on the barrel of an organ; and which acts somewhat similar to that mentioned in the second part of this treatise. The sheds are all formed directly by the harness in this method, and therefore the front leaves are also unnecessary. There are other species of carpets woven in imitation of those brought from Turkey, in the manner of plush velvet, which we have already explained, and to which we have again occasion to advert, under the head tapestry.

CHAP. VI. Crossed Warps.

In the second part of this treatise, we have given an explanation of the general principles of cross weaving, with a particular description of the plain gauze, which is the basis of the whole. It only remains, therefore, in this place, to take notice of some of its most prominent varieties.

Sect. 1. *Varieties of Gauze.*

Fig. 7. Plate 49. is a plan of mounting for a gauze and plain stripe, with a specimen of the texture annexed. The four treadles at A work the plain stripe C, in conjunction with the stripe of gauze at *a*; and the set of treadles B, are corded to weave the plain stripe in conjunction with the vein stripe at *b*. In the gauze part, every third thread of weft only enters into the fabric of the gauze, the two intervening ones being cut away when they flush over the gauze after it is out of the loom. At B, all the three shots are thrown into one shed of the gauze, which constitutes what is known by the term veining. The figures at each side refer respectively to the number of the treadles by which the shots of weft are inserted, and point out likewise the order in which the treadles are wrought over. It may be necessary here to remind the reader, that the dots on the treadles denote raising cords, and the crosses, ×, sinking ones, which are applied respectively to the long and short marches of the leaves on which they are placed. The blank spaces, therefore, in this species of weaving, indicate that neither raising nor sinking cords are necessary.

Fig. 8. is a plan of the mounting of that variety of gauze called crape. This is usually denominated a four set of gauze mounting, although it consists only of one set of doups and standards, and four sets of back leaves. The back leaves, however, are not clasped, as in the common gauze, but made with eyes, so that they can either raise or sink the warp, when required. The back leaves in this species of weaving, whatever be the extent of the mounting, must always be in pairs, corresponding to the two back leaves of a plain gauze, so that any one or more of the pairs may be corded to form the gauze twist, while the others are corded to make a plain texture; the difference being such, that the fore leaf of each set is raised for gauze and sunk for plain cloth. The treadle 1. opens the cross shed, and works alternately with each of the others, which produce part plain and part gauze. The succession of treading is also pointed out by the figures annexed to the specimen of cloth. Fig. 9. is a representation of what is called tweeled gauze. Instead of the weft threads flushing over or under the warp as in the common tweel, they are here thrown into a gauze shed, as in the veining, and these sheds are changed by different sets of gauze mounting as in crapes, though upon a more economical principle. Here, in effect, the pattern runs to the extent of four sets of gauze mountings, although it does not require half the number of leaves. The first thread of each split, or that which is drawn through the upper doup of a full mounting, is drawn only on the back leaf 1, and the other half, which effects all the changes, is drawn in regular succession over the other four back leaves, and again through the doups of the four corresponding standards, which are all under-doups. The treadle 1 sinks the back leaf 1, and raises the other four, by which all the warp is brought to the open or parallel state, and conse-

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quently forms the open shed. Each of the other four treadles is so corded as to raise one of the four standards 6, 7, 8, or 9; and consequently crosses that portion of the warp, while the other three standards sink, as in the last instance, and continue the same shed. These changes take place in succession, and produce the texture exhibited in the figure.

It may be proper to observe, that both this and the preceding species of gauze are often woven in mountings of different extent. When the former is woven in two sets, which is often composed of two sets of doups and standards, and one of both leaves, that species of fancy gauze known by the name of victories is produced, and two sets of the latter make purles, &c. Though we have drawn these examples to form oblique stripes after the manner of tweels, yet the draughts may assume all the diversity of form which has been exhibited in the preceding branches of weaving.

Catgut may be considered another variety of gauze, as it only differs from it in having half a turn of the twist more between the shots of weft. There are two different methods of weaving catgut; the mounting of the one consists merely of two back leaves of eyed heddles, and a single doup or beadlam shaft; the other, of two back leaves and a beadlam shaft and standard. Fig. 6. is a plan of the catgut mounting without the standard. The warp is taken through the heddles of the two back leaves A, B, which are eyed in the manner represented. But as the standard is wanting, the beadlam takes a greater range round the other thread of the same split, as represented in Fig. 9. Plate 47. To produce the open shed, Fig. 6. Plate 49. the leaf A is raised and B sunk; at the same time the beadlam shaft 1. is sunk to slacken the lams. In this shed, therefore, it appears that the bead x, with its thread o, passes both under and over the other thread i of the same split, and sinks at last to the bottom of the shed to the left of it. In the cross-shed both back leaves are sunk, which consequently take all the warp down to the race rod, and the shed is at the same time opened by raising the beadlam shaft. Plain cloth is woven by the alternate motion of the two back leaves, the lams being always slack. The treadles p and o are therefore wrought alternately for this purpose.

When catgut is woven with the addition of the standard, the open shed is the same as exhibited in Fig. 8. Plate 47. The warp is drawn in every respect the same through the back leaves as in the preceding method, and the open shed is formed by raising the one and sinking the other, the lams being slack. The cross shed, however, is formed by raising both back leaves and sinking the beadlam and standard. This species of gauze is much adopted in the finer and lighter fabrics of silk, and sometimes for veining in cotton goods.

Sect. II. *Nets.*

In gauze and its varieties, the threads which are twisted together are confined entirely to one interval of the reed, when they are crossed to the right and left, alternately, between the shots of weft; but in nets, either the whole or a part of the warp is crossed before the reed, and the threads of different intervals are occasionally linked together by the weft. That part of the warp which thus crosses or traverses before the reed, and forms the principal variety in the texture of the cloth, is called whip; and as it has more stress to bear than any other kind of warp, it is generally made of two threads twined together. Fig. 10. Plate 49. is a specimen of what is termed the whip-net, from its warp being entirely of whips. The term whip-net, however, applies only to that part of the texture which is opposite to A, and which requires only two back leaves, beside the front mounting, as in the plain gauze.

The texture at B is called a drappet whip-net, and sometimes the balloon-net, and requires the warp to be divided among four back-leaves, as exhibited in the draught. The mounting, in other respects, is the same as that of a plain gauze, with the exception of the beads and the front mounting being placed before the reed. When the open shed of this net is formed, the beadlams are crossed, as represented in Fig. 11. Plate 47. and at a, Fig. 10. Plate 49. by which they are extended over the threads of the adjacent splits. In the cross shed the beads return to their respective standards, as in the corresponding shed of the gauze. The figures at the side of the specimen of texture refer to those on the treadles, and shew the effect they severally produce.

At Fig. 11. will be found a representation of the Paris and mail nets. The Paris net is merely a plain gauze and whip net combined, their respective mountings being identically the same. This texture is represented at A. In the mail net there are three plain shots woven alternately with the gauze shot 1, which is called the key-shot, and which is effected by working the treadle 3, at every fourth tread.

The patent net, or night-thought, is that beautiful texture represented at Fig. 12. The ground is that of the common gauze, and is combined with a whip-net, but differently drawn and interwoven from that at first explained. The two back-leaves, 1 and 2, and the front mounting A, belong to the gauze; the leaves 3 and 4, and the mounting B, work the whip. The reed is between the front mountings A and B. The crossing of the beadlams will be seen at x and z, and also in the elevation of the heddles at Fig. 12, Plate 47. What further relates to this net will be found in Part II. Chap. ii. Sect. 2.

Fig. 13. is the plan and specimen of a net which was formerly woven on the silk, and called the princess-royal. The mounting of this net is the same as that of the night-thought, with a little difference in the order of drawing in the whip, and in the arrangement of the ground. The figure itself will explain this net better than a lengthened description. When these nets are woven without their grounds, that is, only the whip parts, they afford additional varieties of these delicate textures; and it appears pretty evident, from a comparison of the several specimens here given, that a much greater diversity might very easily be produced than have yet made their appearance.

Sect. III. *Lappets.*

In this species of fancy weaving, the ornament is formed on the ground, which may be plain, tweeled, or gauze, by whip, which is likewise double yarn, but much coarser than that used for nets. The whip, however, is not incorporated with the ground, but is merely tacked to it by the weft at the extremities of the figures.

In all the silk lappets, and many which were woven at the commencement of the cotton manufacture, the whip was raised to form the pattern by beadlams, the shafts of which were attached to the lay behind, and a lam or doup from each shaft passed through the reed towards the front, and united in a small glass-bead below the warp. The whip was taken through these beads, so that, by raising any one of the lam-shafts, the whip-thread was drawn toward that interval of the reed through which the lam passed, and then raised above the shuttle, and fastened to the cloth by the weft. When this lam was relieved, another was raised in the contrary direction, which drew the thread of whip across at the face of the cloth, and raised it at a certain distance from the former, according to the range given to the lam-shaft; and thus, by traversing the whip from side to side, at different intervals, figures could be woven on the under surface of the cloth in the greatest abundance and variety.

But when the cotton manufacture became more extended, a much simpler method of traversing the whip was devised at Paisley. This apparatus consisted of a wooden frame, into which was stuck a number of brass needles, one for each thread of whip, with an eye drilled near the point of each. This frame was suspended below the warp, in front of the lay, and attached to it in such a manner, that when the lay was put back, the needle-points were raised above the warp, but sunk again as it approached the face of the cloth. The horizontal range was given by a rack and spring-catch fixed on the upper shell of the lay, and was shifted from side to side by the weaver's hand, which gave it, in every respect, the effect of the beadlams.

This apparatus produced what was called single frame lappets; and those which were woven by two such frames, moving in contrary directions, received the appellation of double-frame lappets. But all the patterns which were introduced by this simple apparatus, though possessing considerable novelty at first, were still very formal; and as the distances between the teeth of the rack were always the same, the patterns assumed a degree of sameness that soon would have become disgusting, had not a more general principle been introduced by the invention of the lappet-wheel.

This is a wheel which the weaver attaches to the side of his lay, with its circumference divided into a number of teeth, like a ratchet, equal to half the number of shots in his pattern. On one of its flat sides is described a number of concentric circles, corresponding to the same number of splits in the intended reed; and lines are drawn across them from the centre of the wheel to the several teeth in the circumference. When the pattern is drawn on design-paper, the spaces, counted from right to left, represent so many splits of the reed, and, consequently, correspond to an equal number of concentric circles on the wheel. And as each space on the design represents two threads of whip, the number of these spaces, counted from top to bottom, will be equal to the number of teeth round the wheel, for the needle-frame is moved twice by the hand between the shifting from one tooth to another. As the various dimensions of the pattern may be thus easily traced on the side of the wheel from the design-paper, a groove is cut round it of different breadths agreeably to the design, into which an iron pin works, which is attached to the end of the shifting rod connected to the needle-frame; and hence any range may be given to the needles, and any pattern produced that has previously been drawn on design-paper. The thickness of the pin, however, must be added to the breadth of the groove in cutting the pattern.

Chap. VII. Miscellaneous Operations.

In this chapter we shall explain some processes which did not come with propriety under any of the foregoing heads.

Sect. I. *Ribbon Weaving.*

This is a branch of the silk manufacture, and is conducted on principles similar to the other species of fancy or ornamental weaving which have been explained. The webs, however, are very narrow; but the smallest kinds are woven by an apparatus similar to the inch-loom, yet these are restricted to certain breadths. The other kinds of ribbons are woven by the hand, and are mounted like those looms we have explained for weaving plain cloth, tweeling, flushing, or spotting, according to the species of ornament to be produced. The warps are made of tram-silk; the China ribbons being wefted with hard silk, and the sarsenet with soft.

Ribbons are also distinguished by the fringe or purle, as it is termed, at the selvage. These are woven by means of hairs, which are raised and sunk by certain treadles, similar to the method employed sometimes by weavers for working the fringes of shawls by the weft. The hairs are moved by means of small slips of wood attached to the treadles, on which the weaver occasionally shifts his foot as the hairs are to be raised. The purles are single or double, according to the number of hairs thus employed; and as they are fixed by their ends behind the heddles, every time the weaver draws over the wrought cloth, the hairs, which constitute merely a temporary warp, are drawn out, and leave the fringes in the state we see them. Three or four hairs are generally used at each side, according to the extent of the purle.

In this, as in the other branches of fancy weaving, when the patterns become too extensive for the common mountings, recourse is had to such expedients as have been described in the second part; and when these are likewise too limited for the range of pattern, the ultimate recourse is the draw-loom, on which the range may be extended at pleasure.

After the ribbons are taken out of the loom, they are finished by rubbing them well between two polished sticks with sharp edges, which gives them a beautiful gloss. Those narrow ribbons, which are

Weaving.

woven like tapes, besides their being restricted with respect to breadth, must likewise have no purle at the selvage.

Sect. II. *Hair-Cloth for Chair-bottoms.*

This species of cloth is composed of linen-yarn, dyed black, for the warp, and the hairs of horses tails, likewise dyed black, for the weft. The warp is prepared and put into the loom in the same manner as other chains, and the mountings are also similar to those employed for weaving plain, tweeled, or flushed textures, agreeably to the texture of the piece. The warp, however, is dressed with size or thin glue; and the weaver, instead of sitting at the centre of the loom, places himself at the right side, at which side the treadles are also placed. On the left side sits a young girl, who has a square box, into which she holds a bundle of the hairs, wrapt in a wet woollen cloth to keep them moist, and which she picks out, one after another, as the weaver is ready to receive them. The weaver employs a shuttle, somewhat longer than the breadth of the web, in one end of which is a hook, with a small pulley in it, to prevent friction when the hair is passing over it. The weaver holds the shuttle by the other end in his right hand; and as he opens the sheds he puts it quite through, and the girl places a hair on the hook at the point, and holds by the two ends, while the weaver draws back the shuttle, letting that in the right hand go when necessary, but holding by the left until the other end is drawn out at the opposite side of the cloth. After striking up the shot with the left hand, the weaver opens another shed, puts through the shuttle, and draws back another hair which is placed on the hook by the girl, then draws it up with the lay; and in this manner the work is conducted with a degree of dexterity that could scarcely be expected. When the cloth is woven, it is well dressed with brushes, and afterwards pressed.

Sect. III. *Tapestry.*

The weaving of tapestry, which is said to have been brought to England from the Levant during the Crusades, has a very near resemblance to the process of weaving in India, and also to that of the fine Turkish and Persian carpets. There are two methods of weaving tapestry, which are distinguished by the titles of high and low warp, from the positions the warps are placed in while weaving.

In the high-warp tapestry the warp is placed in a vertical position, the two beams being secured in an upright frame; that for the yarn uppermost, and the cloth-beam below. The sheds are opened by means of what are termed coats, which are small pieces of twine, with a loop or eye at one end of each for the warp-threads to pass through, and the other ends are fastened to the coat-stave, which extends from one side of the piece to the other. By means of these coats, any portion of the warp may be separated from the rest, and a passage or shed opened for the

2

Weaving.

broaches on which the silk, woollen, or other kinds of woof are wound. When the threads of woof are inserted in any particular place, they are struck up by an open reed or comb, in the same manner as practised in India. The weaver also makes use of a pointed instrument, with which he adjusts any of the threads that have not been sufficiently regulated by the comb. To assist the operator in the formation of his pattern, the outlines, and other principal members of the figures, are drawn with a pencil upon the warp from the design to be imitated; and the original is hung up behind him, to which he occasionally looks as he proceeds, in order to correct any parts that may have been done wrong. In weaving the Turkish and Persian carpets, the design is divided into small squares, like our design papers and the same is done on the warp; so that, as the weaver proceeds, he inserts the coloured weft into those figures which correspond with the same colours on the design.

The low-warp tapestry is wrought on a loom somewhat similar to the common loom. The weaver has his pattern spread below the warp, which he frequently separates to examine if he is correct. The coats are connected to small tumblers or jacks, and so arranged that the weaver can engage or disengage his treadles at pleasure, as he has occasion to open his sheds in any part of the piece.

Explanation of Plates.

Plate 43.—Figs. 1. and 2. apparatus for winding; Figs. 3, 4, 5, 6, and 7, apparatus for warping; Fig. 8. apparatus for dressing by power.

Plate 44.—Fig. 1. a front view, and Fig. 2. a side view of the power-loom; Figs. 3, 4, 5, 6, and 7, views of the tape or incle-loom, and its different parts.

Plate 45.—Figs. 1.—11. different forms of heddles; Fig. 12. patent net; Figs. 13. and 14. mountings of the four-leafed tweel; Fig. 15. mounting for cross weaving; Fig. 16. gauze mounting; Figs. 17. and 18. diaper mounting.

Plate 46.—Figs. 1, 2, 3, and 4, apparatus employed as substitutes for treadles; Figs. 5, 6, and 7, back-harness; Figs. 8, 9, 10, and 11, the draw-loom and its different parts.

Plate 47.—Fig. 1. the patent or comb draw-loom; Figs. 2, 3, 5, and 6, different parts of it; Figs. 8. and 9. Mr Ferguson's draw-loom; Fig. 10. Mr Cross's draw-loom.

Plate 48.—contains figures for illustrating the different kinds of textures; as regular tweels, broken or satin tweels, reversed tweels, dornich, diaper, and damask and flushing.

Plate 49.—Figs. 1, 2, 3, 4, and 5, draw-loom patterns; Fig. 6, catgut; Fig. 7. gauze and plain stripe; Fig. 8. crape; Fig. 9. tweel-gauze; Fig. 10. whip-net; Fig. 11. Paris-net; Fig. 12. patent-net; Fig. 13. princess-royal net.

INDEX.

CLOTHO, according to ancient mythology, was the youngest of the three *Parcæ*, or Fates, who fixed the term of human life, and was represented wearing a crown with seven stars. covered with a variegated robe, and holding a distaff in her hand. The name is derived from the Greek word, which signifies *to spin*; and, according to the fable, the distaff was held by Clotho, the thread was drawn by Lachesis, and it was cut by Atropos.

CLOUD, a collection of aqueous vapours suspended in the atmosphere, and formed by certain changes from the invisible vapour which is carried up by the process of evaporation. See CHEMISTRY and METEOROLOGY.

CLOVE-TREE, or CARYOPHYLLUS AROMATICUS, a native of the Molucca Isles, furnishes the spice of commerce, and is arranged in the Polyandria class of plants.

CLOVER-GRASS, the name of several species of trifolium, some of which are cultivated as food for cattle. See AGRICULTURE and BOTANY.

CLOVIS, was the first conqueror of the several provinces of Gaul, which before his time had been under the dominion of the Romans, Germans, and Goths, and having united them to the small territory of France, removed the seat of government from Soissons to Paris, which became the capital of the new kingdom, and is considered the founder of the French

CLOTH MANUFACTURE.

PLATE

WINDING MACHINE.

Fig. 1.

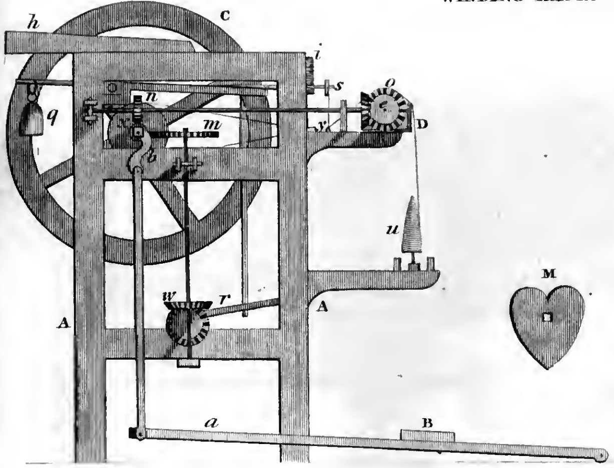
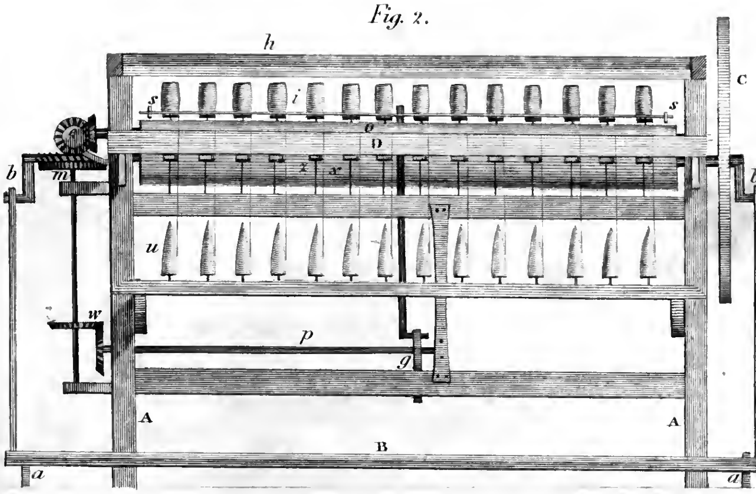
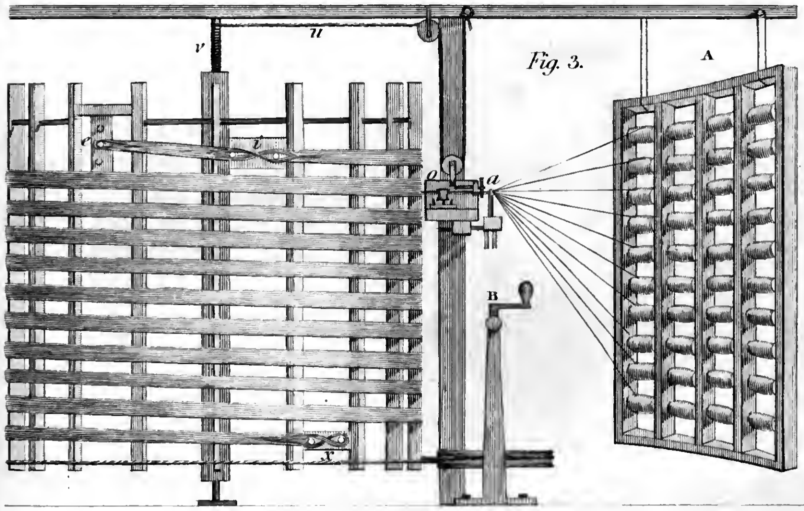


Fig. 2.



WARPING APPARATUS.

Fig. 3.



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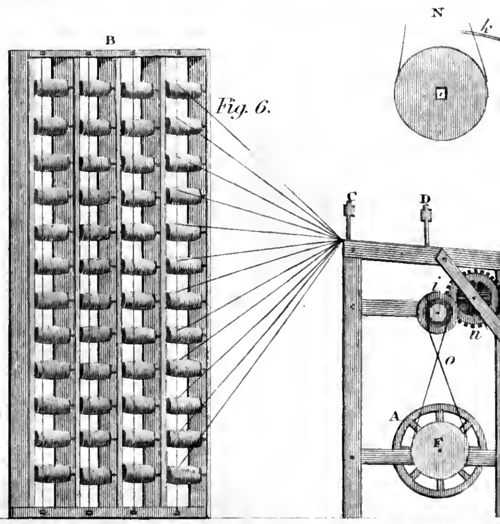
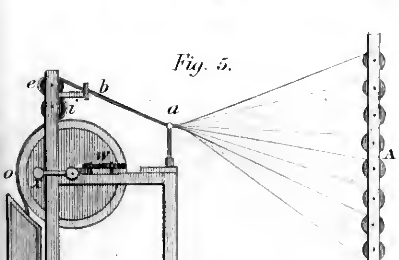


Fig. 5.



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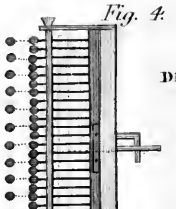


DRESSING MACHINE.

Fig. 7.

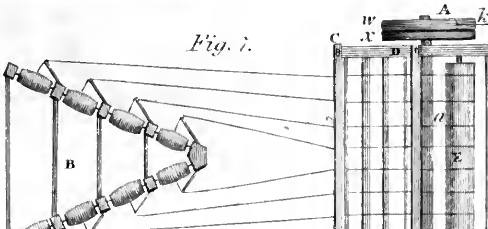
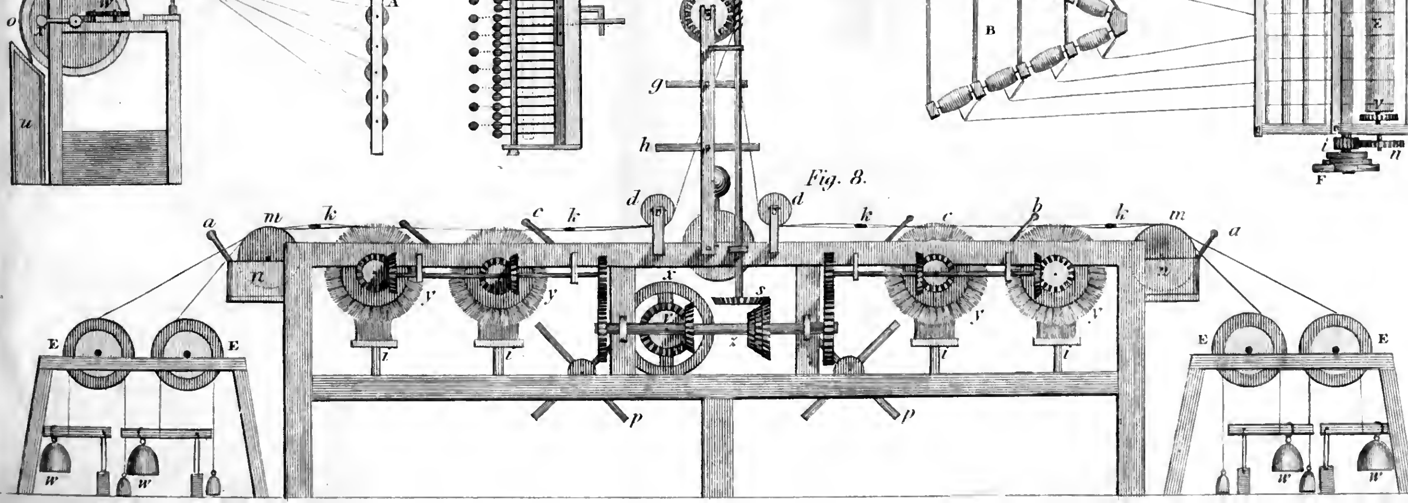
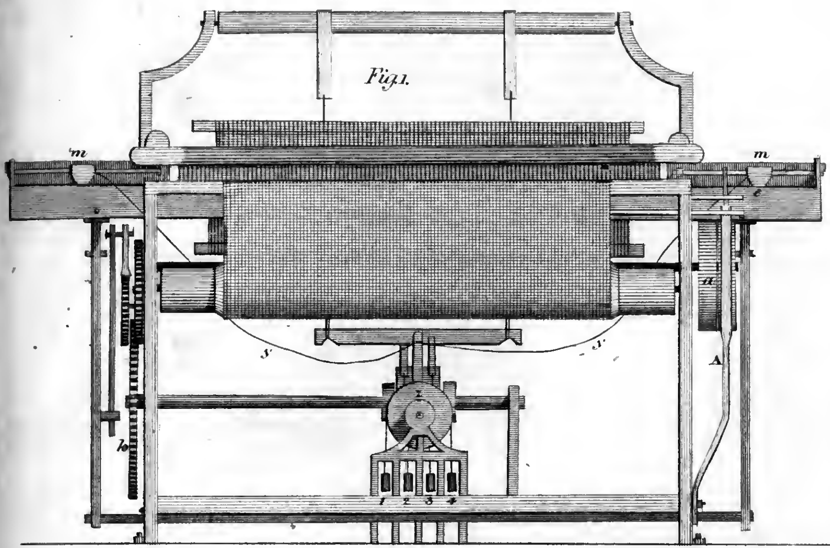


Fig. 8.



CLOTH MANUFACTURE.

POWER LOOM.



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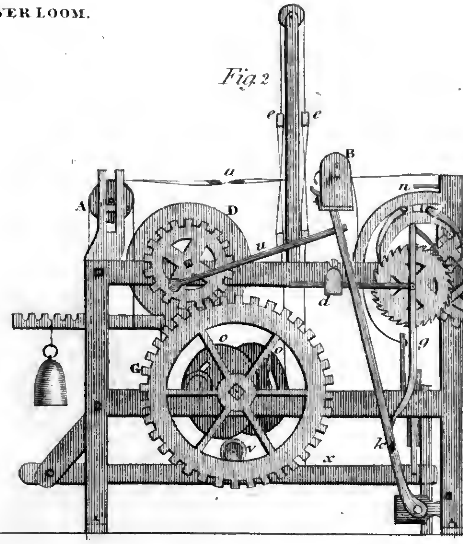


Fig. 2

TAPE LOOM.

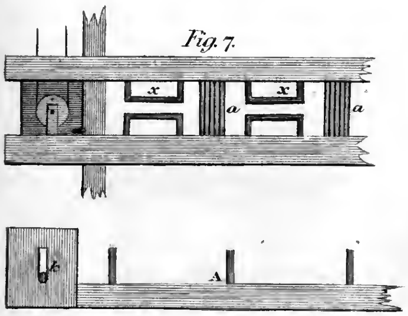
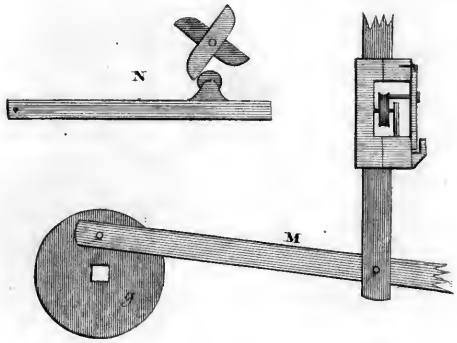
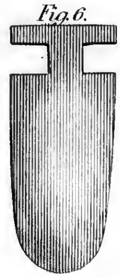


Fig. 7.

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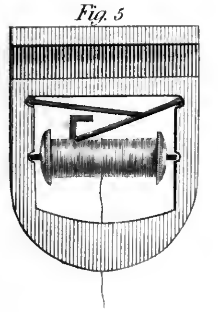


Fig. 5

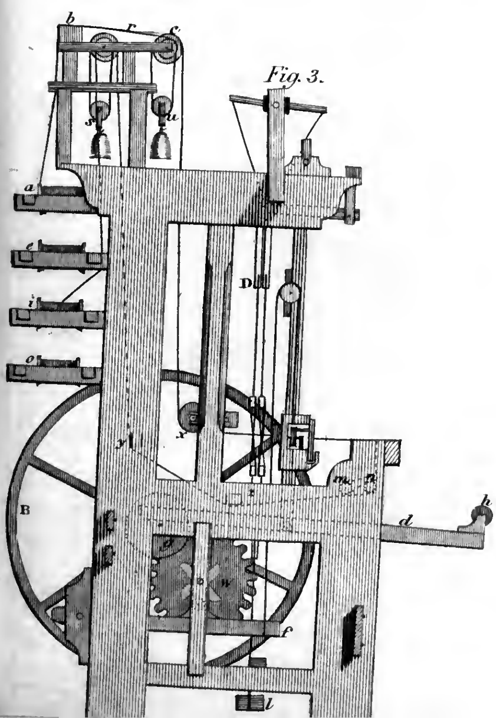


Fig. 3.

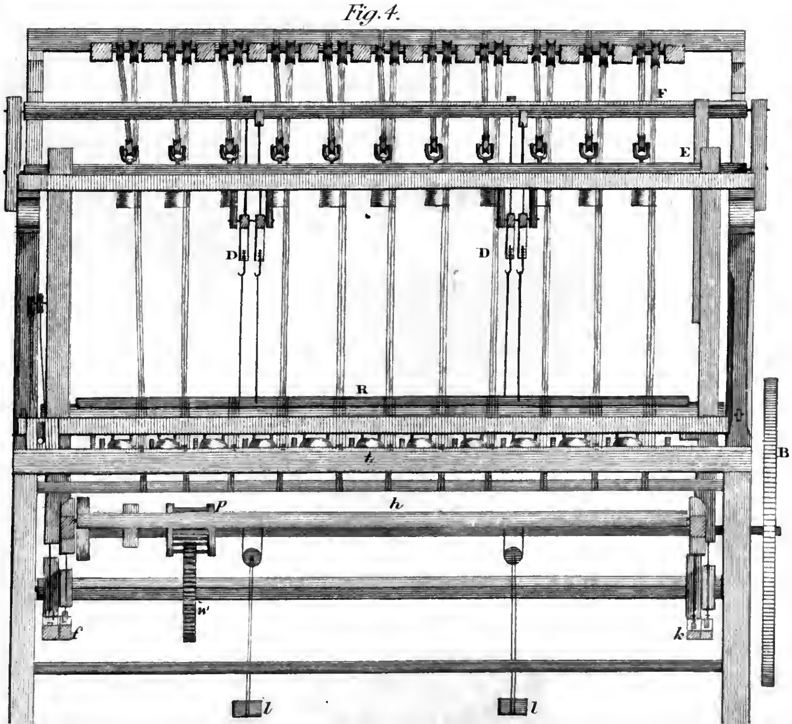
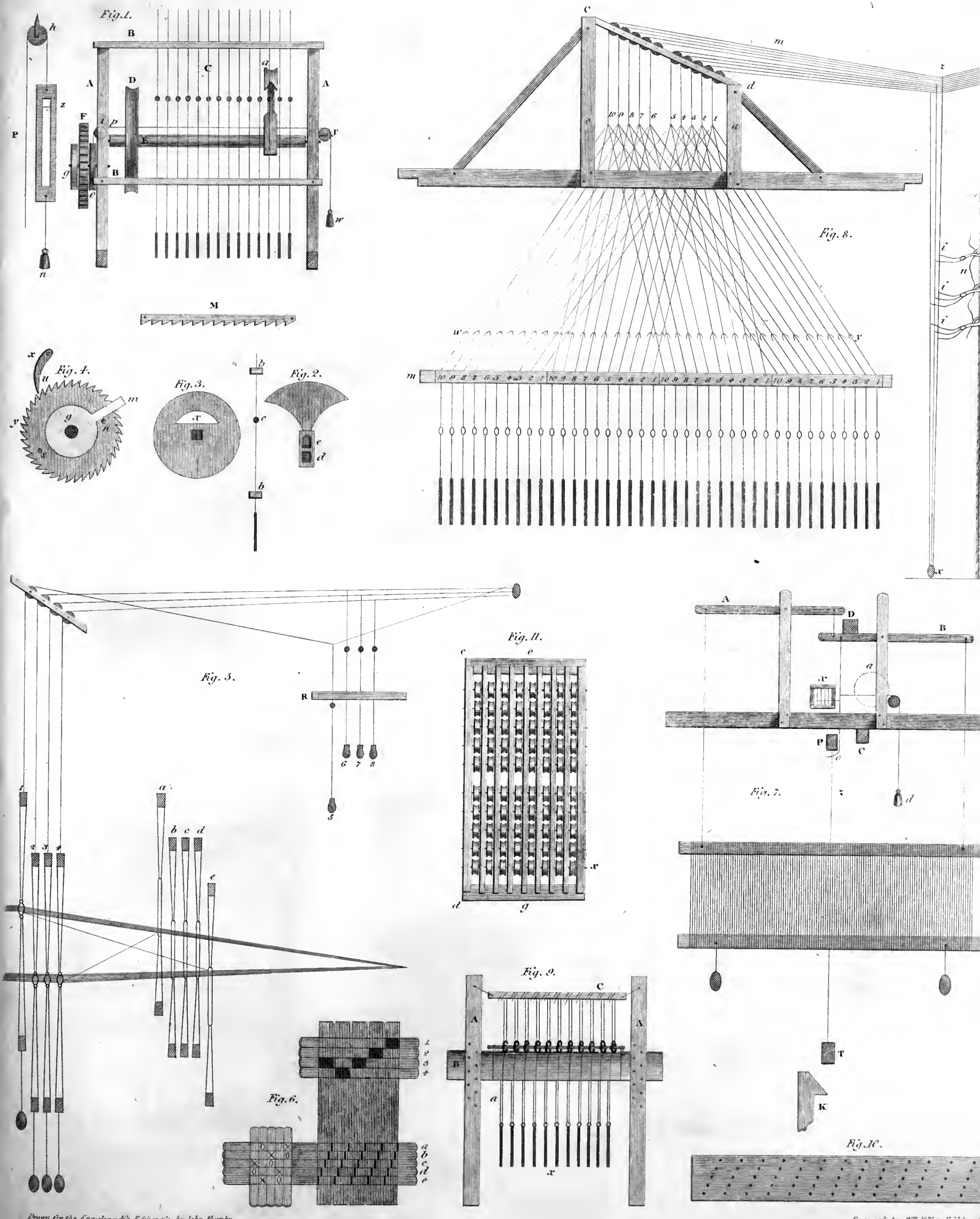


Fig. 4.

CLOTH MANUFACTURE.



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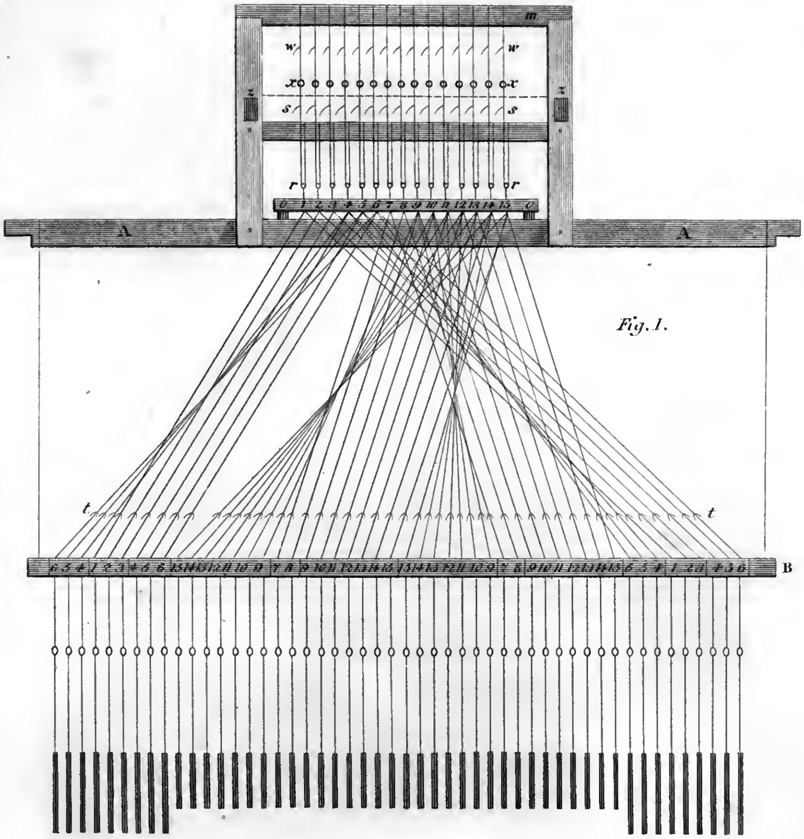


Fig. 1.

Mr FERGUSONS DRAW LOOM

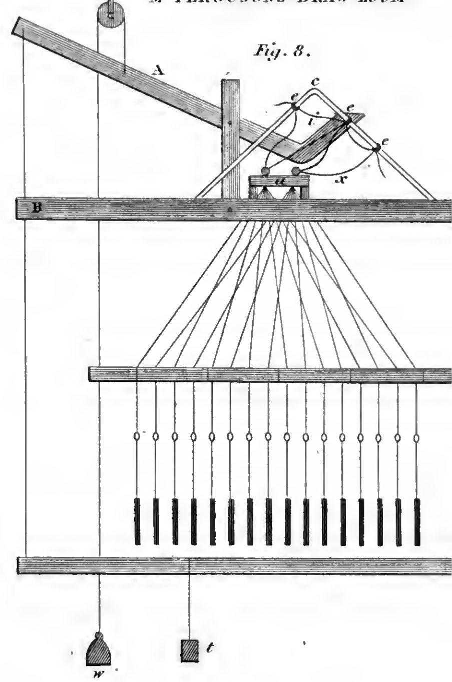


Fig. 8.

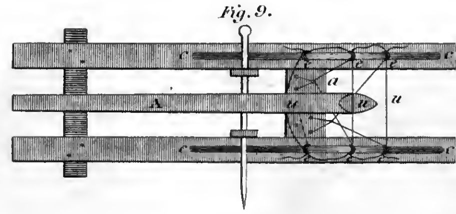


Fig. 9.

Mr CRO[...]

DRAW LOO[...]

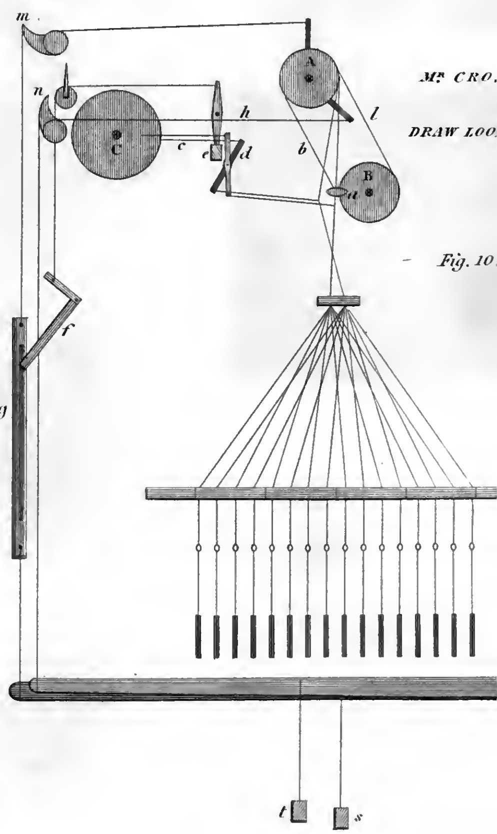
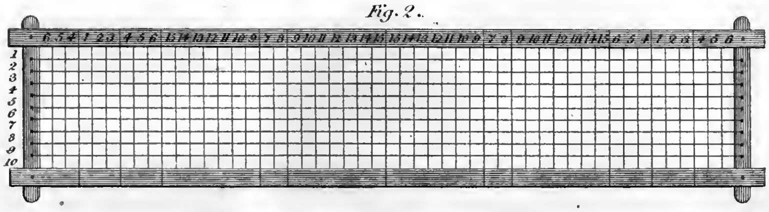


Fig. 10



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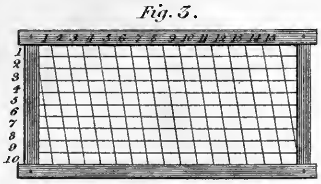

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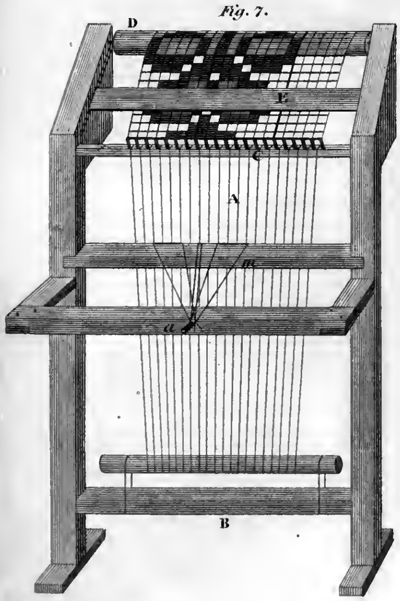

Fig. 7.

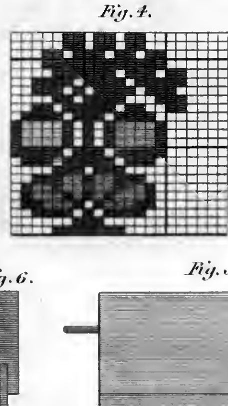

Fig. 4.

Fig. 6.

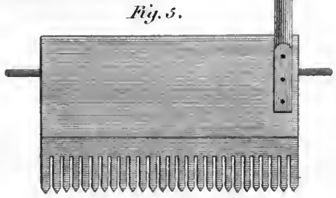

Fig. 5.

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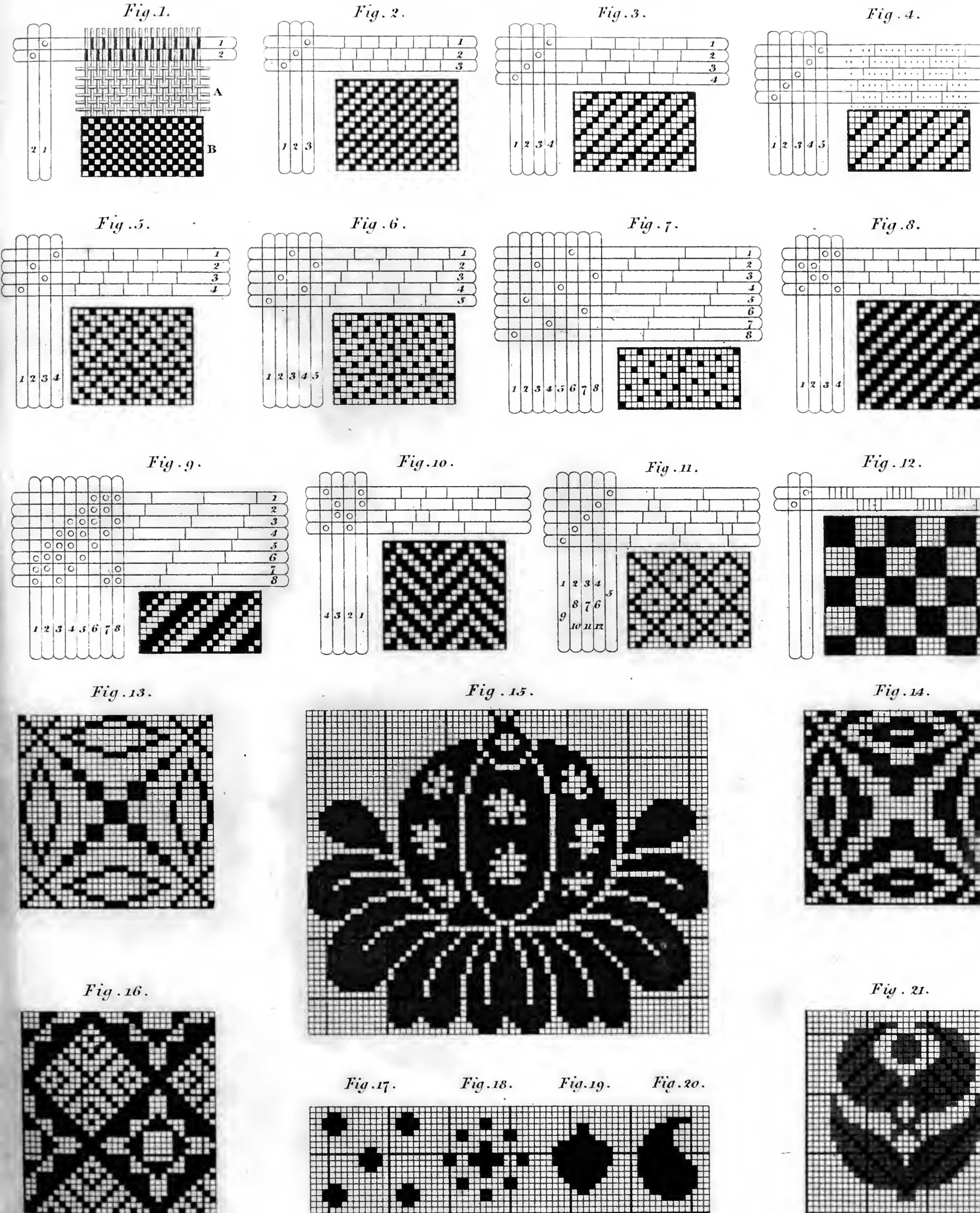
CLOTH MANUFACTURE.

TWEELING, FLUSHING &c.



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CLOTH MANUFACTURE.

Draw loom Patterns.

Fig. 1.

Fig. 2.

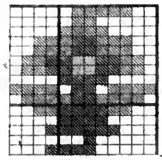


Fig 3.

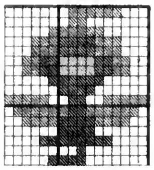
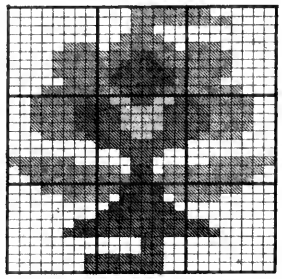


Fig. 4.



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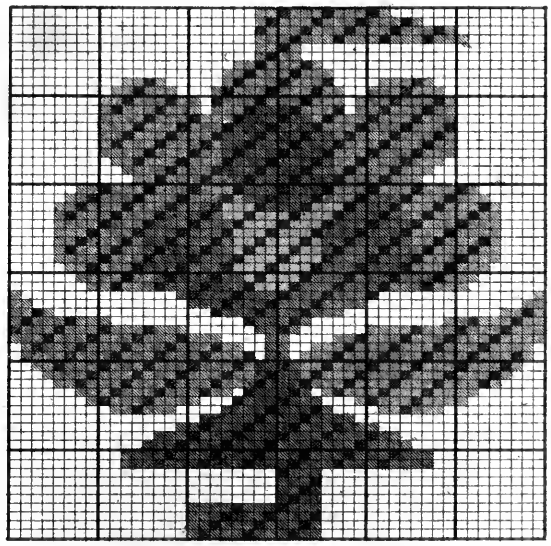


Fig. 7. Gauze and Plain Stripe.

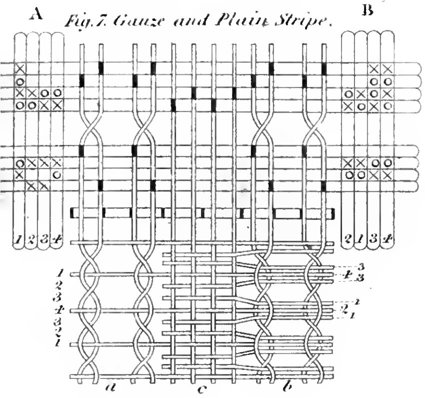


Fig. 6. Catgut.

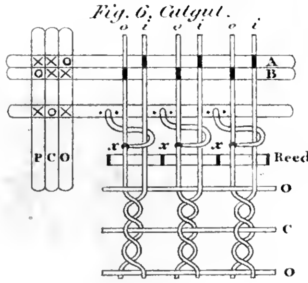


Fig. 12. Patent net.

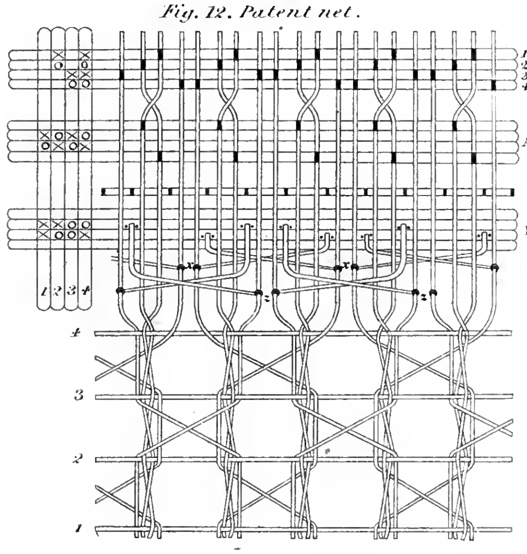


Fig. 8. Crape.

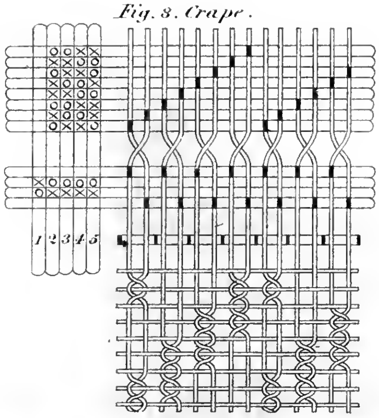


Fig. 9. Tweeled gauze.

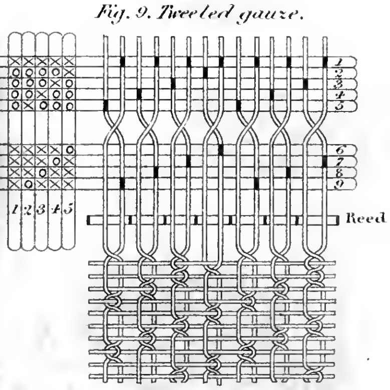


Fig. 10. Whip net.

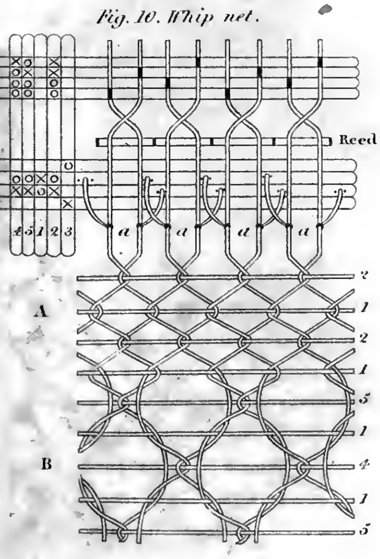


Fig. 11. Paris net.

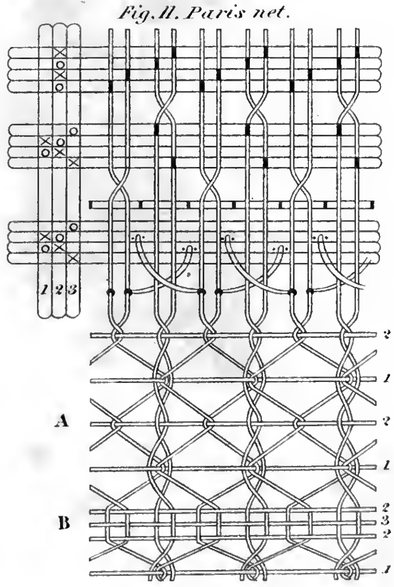
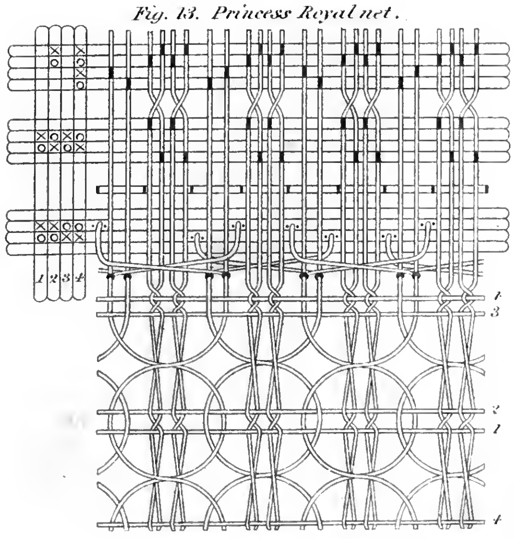


Fig. 13. Princess Royal net.



monarchy. He died in 1511, after a reign of 31 years, and when he had reached the 46th year of his age.

CLOYNE, a town in the county of Cork, in Ireland, 15 miles east from the city of Cork, and the see of a bishop.

CLUNY or CLUGNY, a town in the department of the Saone and Loire, in France; stands on the banks of the Grone, between two mountains, contains nearly 4000 inhabitants, and has manufactures of woollen and silk stuffs, with some trade in wines, corn, and sheep skins. But Cluny is most celebrated on account of its famous abbey, which was the chief of a congregation or order of Benedictine monks, originally founded, it is supposed, in the beginning of the tenth century. This order of monks was introduced into England about the time of William the Conqueror, and in a short time acquired numerous establishments in Britain. The abbey of Cluny, which is now in ruins, was, in the early part of its history, of such extent and magnificence as to be capable of receiving within its walls the head of the church, with a numerous train of ecclesiastics of the highest dignity, and several crowned heads, with all their retinue at the same time.

CLUPEA, a genus of fishes belonging to the order Abdominales, and including under it the herring, the sprat, the shad, and the anchovy, beside several other species, which, being natives of warm climates, are less known. See ICHTHYOLOGY.

CLUSIA, the BALSAM TREE, a genus of plants belonging to the Polygamia class.

CLUYTIA, a genus of plants belonging to the Diœcia class, some species of which are natives of Egypt, and of the Cape of Good Hope.

CLUVIER, PHILIP, better known by his Latin name, CLUVERIUS, a celebrated geographer, was a native of Dantzic, where he was born in 1580, and, according to the custom of the times, having travelled through most parts of Europe, he settled at Leyden, where he seems to have devoted himself to geographical studies. He died in 1623, and was the author of *Descriptions of ancient Germany*, *ancient Sicily*, *ancient Italy*, and of *an introduction to universal Geography*, which latter, at no very distant period, was employed as a text-book. All these works were written in Latin.

CLYDE, a river of Scotland, which has the greatest part of its course in Lanarkshire, and is celebrated on account of the rich and romantic scenery of its banks, especially of the three falls, which are well worthy of being visited by strangers.

CLYPEOLA, TREACLE-MUSTARD, a genus of plants belonging to the Tetradynamia class.

CNEORUM, WIDOWWAIL, a genus of plants belonging to the Triandria class.

CNICUS, BLESSED THISTLE, a genus of plants belonging to the Syngenesia class.

COACH, is a word, which, strictly speaking, is employed to denote a close wheel-carriage, capable of holding four or more persons sitting opposite each other; but under this title we shall treat of all kinds of wheel-carriages, used either for pleasure, state, or the convenience of travelling; distinguishing the several varieties in ordinary use, tracing the origin and progress of these useful contrivances, and describing the most approved methods of constructing them.

Parts of a Carriage.—To understand the following descriptions, it is necessary to notice the principal parts that constitute a carriage. All these vehicles are composed of two primary parts,—the *body*, containing the seats for the passengers, and the *carriage* by which the body is suspended, secured, and set in motion. The body is composed of a *frame-work* and *pannels*; some have a *roof*, which is either fixed or moveable; some have *doors*, furnished with windows, and provided with *blinds* or *curtains*, and most have a projection at the *back* called the *bulge*, for depositing swords, sticks, or umbrellas. In most, the inside is formed into *elbows* at the *quarters*, for leaning on, and with *holders* for holding by, and, in general, there is attached to the body *foot-steps*, for the convenience of getting in and out. Coaches have also usually *seat-boxes* to serve as trunks, and often there is a cavity, formed like a well, below the floor of the vehicle, for secreting money or jewels; and, of late, the roof is constructed so as to receive a sort of broad shallow portmanteau, called an *imperial*. In carriages with one seat, the front part is carried upwards with an easy curve, so as to form the *foot-board*. To the upper part of the front of the body are fixed the *lamps*.

The *carriage* is much more complex; but its essential parts are the *perch*, the *bars*, the *axle-trees*, the *wheels*, the *pole* or *shafts*, the *springs*, and *spring-stays*. The perch is that long and strong beam, usually of wood, that runs lengthwise below the body, and to this are fixed the bars, the lower carriage, and the axletrees; where there are two axletrees, the fore one moves upon a centre-pin, for the convenience of turning. A wheel is composed of the *nave* or centre piece that fits on to the extremity of the axle, the *spakes* that are morticed into the nave, and are at their outer extremities inverted into the *felloes* or *fellies*, which, when united at their ends, form the *rim* or outer circumference of the wheel, and this outer edge is strengthened by a thick continuous circle of iron. Where the nave joins the axletree, there is a *box* so adjusted as to receive and retain an oily matter for preventing friction, and the wheels are secured from coming off by pieces of iron called *linch-pins*. Where the carriage is drawn by two or more horses the perch is terminated by the pole, and where only one horse is yoked immediately to the carriage, there are shafts extending from the front bar or lower carriage. The *springs* are formed of thick plates of well tempered steel, and are placed both before and behind, connected with the body by leather straps and iron stays, so as by their elasticity to facilitate the movements of the body, and prevent jolting. There are also several common appendages to the carriage, as the driver's seat, called *coach-box*, when it is flat and covered with a *hammer-cloth*,—or a *dickie*, when it is shaped somewhat like a chair; the *foot-board* behind, for footmen to stand on; the *boot* or cavity below the coach-box for holding luggage, and sometimes a similar cavity behind, called the *box* or *basket*. There are also various rings, hooks, and staples for fastening the harness, the *drag-chain* for stopping one or more of the wheels in going down hill, &c.

Kinds of carriages.—Modern luxury, and the emulation of coach-makers, have so multiplied the variety of carriages as to render it difficult to describe all those that are in use at any one time. It will be sufficient here to mention those of permanent establishment. Wheel-carriages are usually distinguished according as they are supported on two wheels or on four; though we have heard of a fashionable breakneck vehicle moving on *one* wheel, and carriages are occasionally seen with three. But the taste or convenience of our times has occasionally departed from the old classification, and set some close carriages on two wheels, while it has accommodated some open ones with four. On the whole, therefore, it is better to arrange them according to the simplicity or complexity of their *bodies*.

Gig, or *one-horse chaise.*—One of the simplest wheel-carriages is the gig, an open-bodied vehicle, capable of holding two or three persons sitting with their faces towards the horse, sometimes with a board behind for a servant or a trunk, having a foot-step or two fixed to the shafts, and moving on two wheels. In order to fence against the weather, the gig is often furnished with a moveable leather head, folding up and down by means of joints, and with a leather *apron*, extending from the foot board before, and buttoning on at the elbows. Lamps are often placed in front of the elbows. This carriage was formerly called a *whisky*, or *one-horse chaise;* and a modification of it, set rather high, and having a boat or box below, has been termed a *buggy*. The gig is usually drawn by one horse, and driven by a person who sits in it. When it is drawn by two horses, they are yoked one before the other, and the carriage is then called a *tandem*, a name probably given by some university student, from a play on the Latin word that signifies *at length*.

Taxed-cart.—To avoid the heavy tax on wheel-carriages with springs, a plain one-horse chaise, without springs of steel or iron, is used by farmers and others in the country, which are subject to a smaller duty, and called *taxed carts*. They are much more used in England than in Scotland, their number in this country never having exceeded 400. These carts are sometimes suspended on leather straps, and pay an additional duty.

Curricle.—Nearly allied to the *gig*, but lighter and more ornamented, and drawn by two horses, is the curricle, in which the horses are yoked abreast.

Phaeton.—The phaeton, as to its body, resembles a curricle, but set extremely high, and the carriage has four wheels. It is drawn by two or four horses, and driven like the gig and curricle. From its great height, showing the aspiring disposition of the driver, in imitation of the son of Phœbus driving his father's chariot, this carriage has derived its name. A similar carriage as to the form of the body, number of wheels, and mode of driving, but placed as remarkably *low*, is the *cabriolet*, drawn by ponies.

Chariot.—A close carriage, with one seat capable of holding three persons, having four wheels, and drawn by two or four horses, usually driven from a coach-box. Sometimes the driver sits on horseback, or *rides postilion*, and generally, when there is more than one pair of horses, the front pair are driven by a postilion. Similar to the chariot, but without a coach-box, and built in a plainer and lighter style for the purposes of travelling, is the *post-chaise*. Sometimes the roof and quarters of a chariot are made with joints so as to fold back, by which contrivance it is converted into an open carriage called a *landaulet*.

Coach.—The *coach* is now become the foundation of several varieties, both of close and open carriages. The ordinary coach is calculated to hold either four or six persons, is drawn by at least two horses; is driven from a coach-box or dickie, and has four wheels; but sometimes it is calculated to hold eight persons sitting sideways, when it is called a *long-coach*, sometimes it is driven by a postilion and is called a *post-coach*, and sometimes it runs upon two wheels, when it is often termed a *noddy*. A *stage-coach* is large and heavy, furnished with every accommodation for passengers and luggage, as a boat and basket, iron rails round the roof for passengers to hold by, &c. *Mail-coaches*, again, are built for expedition, have a seat behind for the guard, and a strong-box well secured for letters and parcels. There is a small coach intended for holding two persons sitting opposite each other, denominated from this circumstance a *vis-a-vis*. *Hackney coaches* are sometimes built on purpose for plying in the streets, and differ from others in little else but simplicity and plainness, as in London; but often, as in Edinburgh, they are cast gentlemens carriages, and retain much of their original, but now shabby gentility.

Barouche, Landau, &c.—Gentlemens coaches of the present day are often so constructed that the roof can open in the middle, and with the quarters fold back in opposite directions, so as to form an open carriage. Formerly there were several varieties of open carriages with four wheels, called *Barouche*, *Landau*, *Sociable*, *&c.* The *sociable* was formed like the lower half of a coach body, but without a top. The *barouche* was like the sociable, except that it had a moveable top behind, had sometimes doors and sometimes leather to close the entrance, and a dickie in front; and the *Landau*, (so called from the place of that name,) was furnished with doors and a folding top both before and behind. At present, both are so built as to be capable of closing at top to form a coach, or these vehicles are thus rendered mutually interchangeable.

Coaches are sometimes more completely accommodated to the purposes of long journies, by having a projection forward at the lower part, so as to admit of the traveller lying down on a mattress, and by having various lockers, and a folding board for a table, &c. as most of our readers have seen in the famous carriage of Napoleon Buonaparte, captured at the battle of Waterloo, and lately made an object of public exhibition.

History of Carriages.—At what period or in what country wheel-carriages were first invented, is uncertain. We know from Scripture that they were in use in Egypt as a royal luxury about 1700 years before the Christian era, for at that time the Jewish patriarch, Joseph, was intitled by his rank to ride i Pharaoh's second chariot. We know also that, during the wars between the Israelites and the nations of Canaan, war chariots in great numbers were em-

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ployed in battle by the latter; but it does not appear that wheel-carriages were employed by the Jews themselves before the time of David. About a thousand years before Christ, we find Solomon possessed of numerous chariots; and after this period they seem to have formed a necessary part of the royal establishment.

Among the Greeks, chariots for war were in use at a very early period, probably long before the establishment of the public games. Homer mentions them as employed by the Grecian chiefs at the siege of Troy; and after the revival of the Olympic games, at least about 700 years before Christ, the practice of driving chariots became an object of great emulation.

What was the particular form of these carriages, to which our English translators give the general name of chariot, cannot be determined, except in as far as they are illustrated by ancient medals. There seems no reason to doubt that they were all open, though, in the later periods, they appear to have moved on four wheels, and were commonly driven by a servant. The war chariots were probably open behind, and the warrior seems to have stood upright, the more easily to dart his spear or javelin.

The Romans had carriages of various kinds, both open and covered, on two wheels and on four. Those employed in war, and at the Circensian games, were open and two-wheeled, and drawn by two or more horses yoked abreast. Those in which the magistrates rode, or in which the consuls triumphed, were more or less ornamented. Covered carriages were used chiefly by married ladies, and of these there were two kinds, the *carpentum* with two wheels and an arched covering, and the *pilentum*, an easy soft vehicle with four wheels, used as a sort of state carriage at games and festivals. A very splendid carriage with four wheels, and drawn by four horses, was employed at Rome, to convey the statues of certain gods during the Circensian games to the Circus, where they were to repose on couches, as witnesses of the contest. We read of carriages let out for hire at Rome, both within the city and on the public roads.

The Gauls and Britons used chariots in battle, some of which, called *Esseda*, were chiefly for expedition, and others, which Tacitus calls *Covini*, were armed with scythes fixed to the axle-tree, and must have done great execution.

Although the writers of the middle ages have said little on the subject of carriages, there is no reason to suppose that their use was entirely laid aside. After the establishment of the feudal system indeed, riding on horseback was considered more warlike, and the princes and chiefs at the head of those dynasties which were founded on the ruins of the Roman empire, strictly enjoined their vassals to attend them on horseback on all occasions of state or war. Severe edicts were even passed by some sovereigns, forbidding the use of wheel-carriages even to the nobles. So early as the thirteenth century, the luxury of carriages was so common in Paris, that even the citizens wives used them, till forbidden by an ordinance of Philip the fair.

Towards the end of the fifteenth century, covered carriages were generally employed by most of the sovereigns of Europe, both in public ceremonies and in travelling; but it was not till the beginning of the 16th century that the use of this luxury was much extended to the nobility, and then it was confined chiefly to the ladies. Professor Beckmann, who, in his *History of Inventions and Discoveries*, has brought together much information respecting the history of wheel carriages, has given an account of several of the coaches of the 16th and 17th centuries, remarkable for their expensive decorations. In the splendid tournament held at Ruppin in 1509, Joachim the reigning elector of Brandenburg, had a carriage all gilt over for the use of the electress, and twelve other coaches ornamented with crimson; and the Duchess of Mecklenburg appeared at the same tournament in a carriage hung with red satin. Count Kevenhiller, in his Annals of Ferdinand the V. describing the marriage of the Emperor Ferdinand the II. with a princess of the house of Bavaria, tells us that the bride rode with her sisters in a splendid carriage studded with gold, her maids of honour in carriages hung with black satin, and the rest of the ladies in neat leather carriages. At the marriage of the Emperor Matthias, his consort rode in a carriage covered with perfumed leather; and the wedding carriage of the first wife of the Emperor Leopold, together with the harness, cost 38,000 florins. Duke Ernest Augustus, elector of Hanover, had 50 gilt coaches with six horses each.

It appears that though the coaches of this period were furnished with canopies, and sometimes with curtains, they by no means resembled the close coaches of modern times. The upper part was generally formed by pillars supporting the canopy, and few of them were suspended even by leather straps. In the middle of the 16th century, there seems to have been at Paris only three coaches, belonging to the Queen, the Duchess of Angouleme, and the first president of the parliament. Even Henry the Great, who was assassinated in a coach, seems to have had but one. Before the end of the 17th century, however, they were more common; and the coach in which Louis XIV. made his public entrance into Paris, appears to have been suspended on springs.

Carriages of some kind must have been in very early use in Britain, for we read that St. Arkenswald, who died near the end of the 9th century, was carried to prayers in a two-wheeled carriage, and that William, third Earl of Derby, died in the year 1253, in consequence of a bruise occasioned by a fall out of his coach. Previous to the 14th century, the English ladies rode in carriages, called *Whirlicotes;* and when Richard II. was compelled to fly from his rebellious subjects, his mother being indisposed travelled in a carriage, while the king and his nobles rode on horseback. According to Anderson, coaches were imported into England from Germany in 1580; but according to Stow, *(in his Summarie of the English Chronicles,)* one Walter Rippon made the first coach that ever was constructed in England, in 1564, for the Earl of Rutland; and afterwards in 1584, the same Rippon built a hollow turning coach with pillars and arches, and a chariot throne with four pillars behind to bear a canopy, with a crown imperial

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on the top, and the supporters of the English arms resting on two lower front pillars, for Queen Elizabeth. In 1598, the English ambassador went to Scotland in his coach; and in 1605, coaches began to be in common use. Villars, Duke of Buckingham, was the first who drove a coach and six in 1619, an ostentatious pomp, which was ridiculed by the Duke of Northumberland, who drove with eight horses.

Very early in the 17th century, hackney and stage coaches were established in this island; for it appears from the privy seal record of Scotland, that about 1610, Henry Anderson, a native of Pomerania, obtained a patent for the exclusive privilege of keeping coaches to run between Edinburgh and Leith for 15 years. In 1625, there were 20 coaches let for hire in London, and as they were at first established to run between London and Hackney, they were denominated *Hackney* coaches. In 1637, the number of hackney coaches in London and Westminster amounted to fifty; in 1652, to two hundred; in 1654, to three hundred; and in 1661, four hundred were licensed at an annual duty of L.5 Sterling each. In 1694, they amounted to seven hundred; in 1718, to eight hundred; in 1768, to one thousand, and, since that period, their number has increased to above eleven hundred. Hackney coaches are said to have been first established in Edinburgh in 1673, when their number amounted to twenty. This number gradually diminished till 1778, when there were only nine. They have since rapidly increased, and now amount to about a hundred.

The business of coach-making was first practised in Edinburgh in 1696, but it then consisted in repairing carriages that had been made in London. Afterwards a few clumsy carriages were built; but soon after the year 1758, John Home, who had carried on the business for some time at Edinburgh, having gone to London for the purpose of acquiring the improvements which had been made, began to employ separate hands for making different parts of coaches, and in this way the art of coachmaking was brought to such perfection, that not only the nobility and gentry of Scotland were supplied with carriages from Edinburgh, but, about the year 1766, many were exported to the West Indies, and soon after to Holland, Russia, France, and Poland. In 1778, the value on carriages exported from Leith annually amounted to L.2,200.

According to the returns made in 1807, the number of wheel carriages then in Britain stood as follows.

Four wheeled carriages in		
England, - -	19,975	Total, 21,555
Scotland, - -	1,580	
Two wheeled carriages in		
England, - -	42,604	Total, 13,775
Scotland, - -	1,171	
Grand Total,		65,330

The institution of street coaches or fiacres, in Paris, or other continental cities, was posterior to their establishment in Britain, namely, about 1650. The number at Paris, previous to the revolution, amounted to about 1800. In Vienna, about the same time, there were above 3000, and in Copenhagen about one hundred.

There are few civilized countries in the known world in which wheel-carriages are not more or less in use; but in China and the East Indies they are in a great measure superseded by the employment of palanquins. On Lord Macartney's embassy to China, two of Hatchet's most splendid carriages were sent as presents from his Britannic majesty to the Chinese emperor. As nothing of this kind had been seen at Pekin, the Chinese were puzzled more with them than with any of the other presents, and disputed among themselves what part of the carriage was intended for the emperor's seat. As the coach-box of the winter carriage was covered with a smart hammer-cloth, ornamented with festoons of roses, its splendid appearance and elevated situation determined it at once, in the opinion of most of the spectators, to be designed for the emperor, but they were for some time at a loss how to appropriate the inside of the carriage. After carefully examining the windows with their blinds, and screens, they at last concluded that the body of the coach was intended for the ladies of the court. An old attendant being informed that the emperor was to sit within side, while the splendid elevated box was to be occupied by the man who drove the horses, he thought they were jesting with him, and asked, with a sneer, whether it could be supposed that the emperor would suffer any man to sit higher than himself, and turn his back upon him. When assured that the information was correct, he proposed that the coach-box should be removed, and placed behind the body of the carriage.

Having thus traced the progress of refinement in wheel-carriages in ancient and modern times, this division of the subject may properly be concluded by an abstract of the present rate of taxation to which they are subject.

Duties on wheel-carriages.—By act of parliament, carriages are arranged in several classes, according to the number of wheels, or the use for which they are destined. One gentleman's four-wheeled carriage pays a duty of L.12 yearly; where there are two, L.25 for both; three, L 42: four, L.60; five, L.78, 15s.; six, L.98, 8s.; seven, L119; eight, L.140, 16s. and nine such carriages pay L.163, 7s.

Stage-coaches and post-chaises pay each an annual duty of L.10, 10s. Each additional body adapted to the same carriage is charged with the yearly sum of L.6, 6s.

Every carriage with two or three wheels, if drawn by one horse, pays L.6, 10s.; if by two or more, L.9; and each additional body L.3, 3s.

A plain *taxed-cart*, without springs, kept by a person not having a four-wheeled carriage, pays an annual duty of L.1, 9s. if kept for his own use. Ornamented taxed-carts, with springs not made of metal, pay L.2, 15s. Persons who are charged with coach duties, pay for a taxed-cart, L.6, as do those who keep such a cart for hire.

Coachmakers, or coach-sellers, pay an annual duty of ten shillings, and for every four-wheel carriage they sell L. 1, and for every two-wheel carriage 14s. 6d. Makers of taxed carts not being coachmakers, pay an annual duty of 3s., and the same sum for every taxed-cart sold.

The number of carriages charged with these duties in Scotland, in 1812, stood as follows:

Four-wheel carriages used by private persons	1,211
Do. kept for hire, - -	517
Two-wheel carriages in all, - -	1,116
Taxed-carts, - - - - -	354

Construction of carriages.—The *calling* of coach-making, as it is termed by these artists, is confined chiefly to those who make the bodies of carriages, (though it often includes the making of the *carriage*,) and put together the different parts of the vehicle. Hence, this art may properly be divided into body-making, carriage, and wheel-making, coach-iron manufactory, harness-making, trimming, and painting. The first of these requires considerable skill and nicety, both in planning and executing the work; but the branch of coach-painting is the most lucrative. Coachmakers, as a body, are not so numerous as might be expected from the number of carriages that are annually constructed. They are supposed, at present, not to exceed 3000, throughout the British empire, comprehending masters and workmen.

Body-making.—The construction of the body of a carriage, and the adjustment of this to the carriage, are planned by the master coachmaker; and in doing this he is directed partly by his own taste and judgment, and partly by the fashion of the day. He begins by sketching a draft of the whole vehicle, and proportioning its different parts according to a certain scale, and from this draft the principal workman in each department takes his measures and patterns.

The body of a carriage is composed of a great number of pieces of various shapes and sizes, but more or less angular, which must be fitted to each other with mathematical precision.

Most of the frame-work is made of ash, the bottom and roof of fir, and the pannels of mahogany or walnut-tree, all well seasoned wood; and in order to give the whole that curved form which is so much admired in modern carriages, the several pieces are warped into a proper curvature, by exposing one side to heat while cold water is applied to the other. The several joints are cemented together with white-lead and oil, and the frame-work is strengthened by canvass and small wooden blocks glued on the inside; and when the whole is united, the roughnesses, especially on the outer surface, are cleared off in the manner usually employed by joiners. The roof and quarters are covered with leather dressed in a particular manner, so as to have one side remarkably smooth and close. In London, leather for this purpose is dressed by a distinct trade, called there *coach-curriers.* The windows of carriages differ according as the carriage is intended for public or private use. In the former case, as in post-chaises, stage and hackney-coaches, they are made of common window glass and are often divided into panes; but in gentlemens carriages they consist each of a single pane, generally made of plate-glass. As these are very expensive, and are therefore frequently stolen, it is now become fashionable to engrave on each plate the crest of the family to whom the carriage belongs. The body of a carriage is sometimes made of plates of metal, and wherever it is intended to render the carriage *bullet-proof,* such plates form a necessary part of its construction.

Carriage and wheel-making.—The making of carriages and wheels is sometimes practised by the same persons, and is at others the employment of separate workmen. Next to body-making, the construction of the carriage is the nicest and most delicate operation, as here there must be considerable strength both to support the body and to resist the injuries to which the vehicle is exposed during its rapid movements on the road. while at the same time the several parts must be fitted to each other, so as to facilitate and render easy the motion of the whole. The carriage is one continued combination of wood and iron. The wooden part is formed of sound well grown ash, perfectly dry, which last circumstance is particularly to be attended to, that the joints may not separate by the shrinking of the wood. The junctures, as in the body, are cemented by white lead and oil, and secured by iron hoops, plates, bolts, and screws. The cross-bars have a groove below for the axle-trees, and below the fore-part of the *main*-carriage there is a frame of wood and iron called the *under carriage,* so connected with the perch, or what supplies its place, as to permit the fore axle-tree to move easily round. The springs are fastened to the carriage by screw-bolts.

Of late an improvement in the construction of the carriage has been introduced by Mr Brown, coachmaker, of Edinburgh, by which both strength and lightness are secured. The whole carriage is made of wrought iron, and the several pieces are fastened together by hoops, bolts, and screws. Four strong bars hooped together, form the perch, and are curved towards both extremities, so as to join the cross-bar behind and the transome plate before in the strongest manner, and to this latter is screwed a circle, to which is fixed the under-carriage.

The business of the wheel-wright is more laborious than delicate, though in carriage-wheels considerable nicety is required in fixing the parts together, so that no partial strain may be produced. The nave of a wheel is made of hard solid wood, turned in a lathe, and bored through the middle to receive the arm of the axle-tree. That end of the nave which goes next the carriage is called the *in-head,* and is smaller than the other, which is called the *out-head,* and both are bound with iron or plated hoops, to prevent splitting. The out-head is sometimes made close to retain the oil. The inside is lined with iron, that the nave may not wear away too soon. The mortices in the sides of the nave are often so cut, that the spokes shall alternately approach the out-head and the in-head, when the wheel is said to be *cross-dished,* as it is *single-dished* when the spokes form the same angle with the out-head. The nave being thus prepared, the spokes, made of sound oak, are driven into it, when it is ready for the felloes. These are also usually made of oak or ash. In general there are half as many felloes as spokes, so that each felloe receives two spokes. In this case the felloes are formed out of solid wood by an adze, after being marked from a circle previously drawn. But a better method is to form the run of the wheel of two pieces, bent into a semicircle by steam. When the felloes are driven upon the spokes, and secured to these and to each other, the iron *tire* is to be applied. This is done by heating it red hot, by which the iron is expanded, and then adjusting it to the rim by fixers, and securing it by strong nails, whose heads are sunk in the tire. As the tire is made to fit tight, and contracts as it cools, the wooden rim is firmly embraced all round and equally strengthened.

The rim of a wheel is sometimes made cylindrical, or so that the circles at the outside and inside are equal; but frequently it is conical, or one of these circles is greater than the other, so that the whole wheel forms the horizontal section of a cone.

The wheels and axle-trees in Mr Brown's carriage are also of iron, and are made to fit together so as to prevent the wheels from coming off, and to preserve the oil or grease within the nave, so that the coach may run for 1000 miles without any fresh supply.

Metal-work of carriages.—There is a very great variety in the metallic articles employed about a carriage, and most of them are the production of different manufactures, chiefly at Birmingham and Sheffield. Thus, the springs are made by one manufacturer, the bolts, nails, screws, and hoops by another; the plated articles by a third; the footsteps by a fourth; the lamps by a fifth; and the buckles, &c. of the harness by a sixth. What may be called the rough iron-work and the making and adjusting the springs, however, require the particular attention of the *coach-maker*. The iron employed should be of the best and most malleable quality, that it may not snap short, and each piece should be forged equally, that the whole may wear uniformly. Old wheel-tires, gun-barrels, and horse-shoes, are excellent iron for all purposes where toughness is required. A smith is generally employed by coach-makers, both for making and repairing the iron-work of his carriages.

Harness-making.—As besides what is strictly called *harness*, there are many straps and buckles used in the construction of coaches, this part of the business may not improperly be considered before trimming and painting. Harness-making includes the employment of the *saddler* and the *collar-maker*, trades which are frequently carried on by the same person. In this department the workman has little else to do than put together the materials he receives from different manufacturers. His leather he procures from the currier, and it is of different kinds and thickness, according as it is intended for coach-straps, traces, reins, collars, or saddles; his buckles, rings, bits, curbs, stirrups, and saddle-trees, he gets from the manufacturers of these articles at Birmingham or Sheffield, and so on. In fastening together the different parts, the workman uses an awl and hempen-thread, rubbed with shoemakers' wax, and pointed with hog's bristles, as in making shoes.

The nicest operation in this department is *making* saddles for riding-horses. The saddle-tree, made partly of wood and partly of iron-plates covered with canvass, is first covered on the upper surface with girth-web, and lined within with cloth stuffed with wool or horse-hair; and over the top is stretched a piece of very hard close-grained leather, made some times of hogs skin. Below the flaps of this covering are soft cushions or pannels, stuffed with wool, and covered next the horse with serge, and next the flaps with sheep-skin. Below the pannels are fixed the straps for attaching the girths, and at the back of the saddle-tree is a staple for attaching the crupper. Saddles for draught-horses are much more simple.

Collars for the horse's neck are made of leather, stuffed with straw and horse-hair.

Trimming.—Coach-trimming comprehends the lining with all its ornamental appendages of lace, fringes, tassels, &c. the making and covering of cushions, boots, baskets, imperials, and even the covering of the roof, back, and quarters, and the fitting of check-strings, curtains, blinds, and cords. Carriages are lined with cloth, satin, or leather; and within the lining, on the back and sides, there is a stuffing of horse-hair to diminish the effect of jolting. The lining is edged with worsted or silk lace, generally worked according to a fancy pattern, or with an intermixture of crests or coronets; and the straps for letting up and down the windows and the holders are wrought in the same pattern. When the lining is very expensive, there is usually a temporary cover of cotton made to go over it in ordinary travelling. All these works require considerable neatness, both to make the carriage comfortable, and to please the eye of those who ride in it.

Under this head are also included the carpets or rugs that cover the bottom of the carriage.

Painting.—Carriage-painting may be said to be in three styles. The carriage and wheels are painted in the ordinary way; the body in a much superior style, and with much finer colours; and the arms, &c. are executed by the highest rank of carriage-painters, and constitute the most elegant degree of this art. Painting the body is a long and tedious operation, owing to the number of coats that are required. In the first place, the whole is covered with a coating of any common colour, mixed with oil of turpentine, and a considerable quantity of Japan varnish. This operation which is called the *priming*, is repeated three or four times, and at each repetition the quantity of turpentine is increased, and that of the Japan varnish diminished. Then two or three coats are given of a composition of ochre, turpentine, and Japan varnish, for the purpose of filling up any inequalities, to insure which, the more remarkable hollows made by nails, &c. are filled up with a putty formed of white lead ground with turpentine and gold size. The whole surface is now suffered to become completely dry, and is then smoothed with pumice-stone. After this, another ground is laid with a dark or light colour, according as the body is to be finally painted with a deep or a bright shade. When two or three coats of this last *grounding* have been applied, the carriage is prepared for laying on the body colour. Of this, successive coats are applied till the whole surface is perfectly smooth, and of a uniform shade, which generally requires six or seven coats. The body painting is now completed, and the surface has only to be varnished, and the arms, crest, &c. to be emblazoned. The best copal varnish is employed, and of this there must also be several

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coats, taking care after every coat to smooth the surface with pumice-stone, reduced to a fine powder, and applied by means of a hard roll of woollen cloth. The armorial painting is generally executed between the second and third coats of varnish, as before this the varnish is usually mixed with a little of the body colour. After the last coat of varnish has been applied, the carriage is suffered to stand for about a month, when its surface is polished, first, by rubbing gently with very fine powdered pumice-stone and water, then with the finest rotten-stone, and afterwards with the dry hand, and, lastly, with a little olive oil, mixed with a small quantity of flour.

Coal.

COAK, or mineral charcoal, is a kind of fuel which is artificially prepared, and employed in the process of smelting metallic ores, or in iron founderies for the production of intense heats. In the preparation of coak, which is by a smothered combustion, the bituminous or more inflammable parts of the coal are dissipated. Coak is also the residue of coal which has undergone the process of distillation for the production of carburetted hydrogen gas or inflammable air, which has now become familiar in the use of gas-lights.

COAL is a mineral substance belonging to the class of combustibles, and composed of earthy and bituminous matter in variable proportions.

COALIERY.

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Under the term Coaliery, are included all the operations for digging out coal from the strata, beds, or seams, in which it is deposited. Of the vast importance of this mineral substance for the purposes of fuel, no better proof can be adduced than the disadvantages to which those countries are subjected which are destitute of it, and the flourishing state of numerous arts and manufactures in those parts of the world where it is abundant. Various districts, both of England and Scotland, furnish ample illustration of this remark. And since coal is of so much importance, and from the limited extent in which it is deposited it is not to be considered as inexhaustible, it must be the interest both of the public in general, and of the individual proprietors of coal-fields, that it should not only be dug out with care and economy, so as to obtain the greatest possible quantity from the same extent of strata, but that it should be applied with equal care and economy to produce the greatest effect in the various purposes which, from its nature, it is so well fitted to answer.

In the following treatise, the natural history of coal,—the progress of working coal-mines,—the methods of searching for coal,—the methods of working coal,—the ventilation of coal-mines,—and some other operations connected with the subject, will be briefly detailed.

Chap. I. History of Coal and of Coal-Mines.

Those who are interested in the working of coal, either as an object of curiosity or from views of emolument, should be familiar with its natural history, as well as with the principal facts relative to the progress of digging out or working that valuable mineral.

Sect. I. *Natural History of Coal.*

Compared with the surface of the earth, the strata of coal are of very limited extent; and even in those countries where it is found in abundance, as in Britain, it occupies only a few favoured spots, which are usually situated in regions of the earth little elevated above the level of the sea. Every kind of rock is not to be considered as indiscriminately the repository of coal; and in those rocks where it exists, it is found in greater abundance, and of a better quality in certain classes than in others. Three kinds of strata, distinguished by peculiar characters, have been described accompanying coal, while the nature and properties of the coal which they contain, exhibit also a striking diversity.

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Of the different repositories of coal now alluded to, the first to be noticed is that which exists in alluvial land, and it presents sufficiently distinct marks of discrimination. The accompanying strata in this kind of repository are usually clay, sand, and gravel, of which the series and proportion of thickness are very various. The strata, or beds of coal, rarely preserve the same thickness through their whole extent; and the same irregularity is observed in the parallelism of the concomitant strata, for they are usually subject to sudden elevations and depressions. The coal strata of alluvial land are distinguished by another peculiarity, in being free from the interruption of slips or dykes, as in the coal strata of other soils; and the varieties of coal found in this repository are commonly lignite, or bituminized wood, common brown coal, moor-coal, and sometimes, but rarely, pitch-coal. This kind of repository of coal is not of unfrequent occurrence in different parts of the world. The Bovey coal, found near Exeter in England, is deposited in alluvial soil, and furnishes an appropriate example.

The second kind of repository of coal has been denominated from the prevailing rocks, trap, or basaltic soil, in which the number of accompanying strata is not very great, and their parallelism is found to be less perfect than in coal strata, in which sandstone is the principal rock. In this kind of repository the coal is not covered with shale, but with clay or basalt, and the latter presents no remains of vegetables or animals. Wacken basalt, in a columnar and amorphous form, greenstone porphyry, and argillaceous ironstone, are the principal strata of rocks; dislocations, or slips of the strata, are rarely met with, but whin-dikes are not unfrequent; and the varieties of coal are, pitch-coal, moor-coal, coal-blende, or blind-coal, and sometimes slaty-coal. In the interior of France, mines of coal of this description are not uncommon in different places; a remarkable example of this kind of repository is met with at Meissner in Hessia; and the coal of Bohemia is

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found in the same kind of soil, as well as the coal of Borrowstownness and Bathgate in Scotland.

But the third repository of coal is by far the most general and the most important, not only as the coal which it contains is of a better quality, but as it is found in greater abundance and more accessible. It is one of the essential characteristics of this kind of repository, that the strata preserve their parallelism to a considerable extent. Indurated clay, different varieties of sandstone, bituminous shale, ratchet or rubblestone, which is a soft argillaceous porphyry, or whinstone in a state of decomposition, and is known in Scotland by the name of *rotten-stone;* argillaceous ironstone, marl, and secondary limestone, are the usual concomitant strata of coal in this repository. But the whole of the strata now enumerated do not always exist in the same coal-field; and even when such coincidence takes place, they do not alternate in the same regular series, or retain the same thickness. The thickness of the different beds, on the contrary, is very various; the succession of the strata is in a very different order; and some of the beds, but particularly the limestone, are entirely wanting.

But although beds of limestone are to be regarded rather as a rare occurrence among the strata which accompany coal, it is not unusual to observe extensive depositions of that rock forming, as it were, the boundary of coal-fields. This fact, which holds pretty generally in this country, has been little attended to by writers on Geology. The eastern and southern limits of the coal-field in East Lothian are marked by a great mass of limestone. A very extensive mass of limestone, nearly of the same quality, also forms the boundary of the south and east sides of the coal-field near Riccarton in Ayrshire; and the north side of the coal-field near the village of Stevenston, in the same county, is bounded by a similar limestone. In all the examples now alluded to, coal has been found under the bed of limestone, but it is either in a very thin stratum or of a very inferior quality. The great coal-field of Northumberland and Durham is included on the east and west between two ranges of limestone; and limestone also forms the boundary of the extensive coal-strata of South Wales.

But a more distinct view can be given of the strata which accompany coal, by actual examples of the order in which they succeed each other. The three following tables exhibit the order and thickness of the strata of coal at Whitehaven, Newcastle, and Dysart in Scotland.

TABLE I.—*Strata in Croft-pit at Preston-Hows, to the south-west of Whitehaven;—the whole depth is* 108 *fathoms.*

	Feet.	In.
Soil	1	3
Soil and clay mixed	4	9
Black soil	1	0
1. Brown soft limestone, resembling stone-marl, in irregular strata	9	0
2. Dark-coloured limestone, harder	6	0
3. Yellowish limestone mixed with spar	4	0
4. Reddish hard limestone	2	0
5. Reddish hard limestone, but with finer particles	1	6
6. Hard dark coloured limestone	1	4
7. Yellowish limestone mixed with spar	4	0
8. Soft brown limestone	4	2
9. Soft brown and yellow limestone mixed with freestone	2	6
10. Limestone mixed with yellow freestone	2	0
11. Reddish soft freestone	1	6
12. Red slate striated with freestone in thin layers	2	6
13. Red freestone	42	6
14. Soft red slate	0	6
15. Red slate striated with red freestone in thin layers	25	0
16. Red slate striated with freestone	27	0
17. Strong red freestone, rather grayish	29	9
18. Lumpy red freestone speckled with white freestone	0	9
19. Blue argillaceous schistus speckled with coal	0	9
20. Red soapy slate	13	0
21. Black slate, with a small appearance of coal under it	1	0
22. Ash coloured friable argillaceous schistus	4	6
23. Purple-coloured slate striated with freestone	23	3
24. The same, and under it black slate	4	0
25. COAL I.	1	0
26. Soft whitish freestone	10	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	8	6
31. Strong bluish slate mixed with gray freestone	3	0
32. White iron stone	1	0
33. Freestone striated with blue slate	1	8
34. White freestone striated with slate in thin layers	9	3
35. Dark blue slate	13	6
36. COAL III.	0	9
37. Dark gray shale	15	8
38. COAL IV. with a mixture of slate one inch thick	2	0
39. Gray freestone mixed with ironstone	8	0
40. Hard white freestone	15	6
41. COAL V.	1	0
42. Shale mixed with freestone	8	0
43. Olive-coloured slate adhering to black slate	2	4
44. COAL VI.	1	1
45. Black shale mixed with freestone	8	8
46. White freestone mixed with slate	8	0
47. Dark blue slate	22	4
48. COAL VII.	1	3
49. Black shale mixed with freestone	7	6
50. Strong white freestone	6	0
51. Brown iron stone	3	0
52. Dark gray slate	6	0
53. Dark gray shale, with an intermixture of COAL VIII. about 5 inches thick	5	6
54. Light coloured slate mixed with freestone	5	6
55. Blue slate striated with freestone	10	0

	Feet.	In.
56. Strong white freestone a little tinged with iron - -	2	6
57. Very black shivery slate -	10	3
58. Coal IX. strong, and of a good quality	0	4
59. Soft gray slate - -	0	3
60. Coal X. very black, burns well	0	8
61. Hard black shale - -	1	7
62. Coal XI. mixed with pyrites	1	2
63. Argillaceous schistus, gray and brittle	3	0
64. Blue rough argillaceous schistus	4	6
65. Fine blue slate - -	3	0
66. Freestone mixed with ironstone	3	0
67. Black shivery slate -	6	0
68. Dark blue slate very fine -	5	6
69. Dark blue slate, very brittle -	0	6
70. Coal XII. - -	2	6
71. Soft gray argillaceous schistus -	0	6
72. Argillaceous schistus mixed with freestone - - -	2	0
73. White freestone with fine particles	7	0
74. Blue slate striated with white freestone - - -	4	7
75. Light blue slate, very fine -	3	0
76. Blue slate a little mixed with ironstone - -	12	0
77. Black shivery slate - -	1	0
78. Coal XIII. - - -	0	6
79. Brownish hard slate -	9	0
80. Strong blue slate tinged with ironstone	28	6
81. Dark blue slate, rather inclined to brown, and brittle - -	1	6
82. Blue soft brittle slate - -	0	6
83. Coal XIV. - - - -	1	0
84. Lightish gray argillaceous schistus, brittle and soapy - -	4	0
85. Freestone striated with blue slate	7	0
86. Fine blue argillaceous schistus striated with white freestone -	4	0
87. Black slate, with hard, sharp, and fine particles - - - -	3	0
88. Blue slate, light and fine -	27	0
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 - -	0	4
96. Gray slate - -	3	9
97. Strong white freestone -	5	6
98. Freestone striated with blue slate	0	10
99. White freestone - -	1	3
100. Freestone striated with blue slate	3	11
101. Black slate - - -	0	5
102. Freestone striated with blue slate	1	4½
103. Strong white freestone -	0	4
104. Freestone mixed with blue slate, in thin layers - -	2	4
105. Strong white freestone -	0	5
106. Grayish slate, of a shivery nature	6	0
107. Freestone mixed with blue slate, in thin layers - -	4	0
108. Very strong white freestone -	5	3
109. Fine blue slate -	2	3
110. White freestone striated with blue slate	0	7
111. Fine blue slate - -	0	4
112. White freestone striated with blue slate	2	1
113. Freestone striated with blue slate, in fine particles - -	0	10
114. White freestone in thin layers -	0	4
115. The same, but more friable -	0	5
116. Fine blue slate - -	2	1
117. Coal XVII. - -	7	10

Table II.—*A view of the Strata in Restoration Pit, St Anthon's Colliery, near Newcastle. The depth of this pit is 135 fathoms.*

	Feet.	In.
1. Soil and clay - -	30	0
2. Brown freestone - -	72	0
3. Coal I. - -	0	6
4. Blue metal stone - -	17	0
5. White girdles - -	13	0
6. Coal II. - -	0	8
7. White and gray freestone -	36	0
8. Soft blue metal stone -	30	0
9. Coal III. - - -	0	6
10. Freestone girdles - -	18	0
11. Whin - - -	10	6
12. Strong freestone - -	19	0
13. Coal IV. - -	1	0
14. Soft blue till - -	11	0
15. Soft girdles mixed with whin -	23	0
16. Coal V. - -	0	6
17. Blue and black stone -	22	0
18. Coal VI. - -	0	8
19. Strong freestone - -	9	0
20. Gray metal stone - -	10	0
21. Coal VII. - -	0	8
22. Gray post mixed with whin -	25	0
23. Gray girdles - -	19	0
24. Blue and black stones -	14	0
25. Coal VIII. - -	1	0
26. Gray metal stone - -	12	0
27. Strong freestone - -	36	0
28. Black metal stone with hard girdles	18	0
29 High main, Coal IX. -	6	0
30. Gray metal - - -	27	0
31. Post girdles - - -	2	0
32. Blue metal - - -	4	0
33. Girdles - - -	1	2
34. Blue metal stone - -	30	0
35. Post - - -	1	0
36. Blue metal stone - -	18	0
37. Whin and blue metal -	1	6
38. Strong freestone - -	21	0
39. Brown post with water -	0	7
40. Blue metal stone with gray girdles	14	0
41. Coal X. - -	3	0
42. Blue metal stone - -	18	3
43. Freestone - -	4	0
44. Coal XI. - -	0	6
45. Strong gray metal, with post girdles	12	6
46. Strong freestone - -	7	0
47. Whin - - -	1	0
48. Blue metal stone - -	8	7
49. Gray metal stone with post girdles	16	5
50. Blue metal stone with whin girdles	10	3
51. Coal XII. - - -	1	6
52. Blue gray metal - -	3	8

	Feet.	In.
53. Freestone	12	7
54. The same mixed with whin	12	0
55. Freestone	8	0
56. Dark blue metal	2	0
57. Gray metal stone and girdles	14	0
58. Freestone mixed with whin	18	7
59. Whin	1	0
60. Freestone mixed with whin	6	6
61. COAL XIII.	3	3
62. Dark gray metal stone	3	6
63. Gray metal and whin girdles	10	10
64. Gray metal and girdles	9	0
65. Freestone	3	0
66. COAL XIV.	3	2
67. Blue and gray metal	4	2
68. COAL XV.	0	9
69. Blue and gray metal	12	0
70. Freestone mixed with whin	4	6
71. Gray metal	0	6
72. Gray metal and girdles	6	9
73. Low main, COAL XVI.	6	6

TABLE III.—*Shows the strata discovered in Borland Pit at Dysart in Scotland, which was sunk in* 1788 *and* 1789, *to the depth of* 46 *fathoms.*

	Feet.	In.
1. A coarse freestone	27	0
2. COAL I. called Sandwell coal	4	0
3. Blaes, the pavement of the coal	4	0
4. Hard freestone	14	0
5. Blaes	9	0
6. COAL II.	0	9
7. Hard freestone	20	0
8. Blaes	5	0
9. Hard freestone	4	0
10. Blaes	18	0
11. Hard stone	2	0
12. Gray feaks or bands, *a sandstone* of a lamellated structure, with a mixture of clay and sometimes streaks of coaly matter	9	0
13. COAL III.	0	9
14. Kirk-stone, a porous freestone with balls of ironstone	54	0
15. Blaes	4	0
16. COAL IV.	0	9
17. Blaes	4	0
18. Gray feaks	7	0
19. Hard freestone	2	0
20. Gray feaks	2	0
21. Hard freestone	2	6
22. Gray feaks	12	0
23. White hard bands	6	0
24. Blaes	3	0
25. Pier-stone, a very hard freestone	11	0
26. Blaes	26	3
27. COAL V. the main coal	24	0

The local names are retained in the preceding tables, and although many of them are extremely arbitrary, they may be understood without much difficulty, by comparing the strata in the different tables. But it may be observed, that, *clunch* and *blaes* are applied to a bituminous shale, and grey feaks mentioned in the third table is a shivery foliated sandstone.

Organised bodies.—The remains of animals and vegetables, and particularly of the latter, are not of unfrequent occurrence in the strata which accompany coal. Impressions of plants of the fern and grass tribes, are most common on the shale; but impressions of fishes, or of river shells, as mussels and land snails, are also sometimes met with. Similar impressions are not unusual on the sand stone, as well as the entire mass of the roots, trunks, or branches of trees, which are sometimes in a horizontal position, and compressed as if with great force into a flattened form, and sometimes in a vertical position, seemingly the same in which they existed in the living state. Such trees, it may be remarked, are entirely changed into the matter of the sandstone, with the exception of the bark, which is often converted into a substance of the nature of coal, and often indeed possesses all the properties of true coal, but although organic remains appear both on the common and bituminous shale, the latter of which is almost in immediate contact with the coal, yet it seems a very singular and unaccountable fact, which is not very favourable to the opinion of the vegetable origin of coal, that the coal itself rarely exhibits any traces either of vegetable or animal impressions. It may indeed be alleged, that the vegetable structure has entirely disappeared during the process of nature in the formation of coal. But every kind of coal is not destitute of organic remains. Impressions of plants, of the grass or reed kinds, are common on the surface of the strata of the cannel or parrot-coal of this country; and in some cases, the fibres of which the plant has been composed can be separated into fine silky filaments. But from pretty extensive observation and enquiry, no kind of vegetable remains has been detected in the body of the coal itself. Sea shells are rarely found in the strata which accompany coal. How is this fact in its natural history, it may be asked, to be reconciled with the opinion, that coal has been formed by deposition at the bottom of the ocean?

Varieties of coal.—Several varieties of coal are described, and they are sufficiently distinguished from each other, both by their external characters and their peculiar properties in burning.

1. *Caking*, or *cubical coal*, is of a fine black clear colour, and when it is newly dug out possesses considerable lustre; the structure is lamellated, or, in technical language, the *reed* of the coal is parallel to the bed in which it rests, and the fragments are of a diced or cubical form, from which one of the names is derived. One kind of cubical coal has a caking quality, as it is called, or runs together into a solid mass in burning. This kind is the most abundant in the extensive coal fields in the north of England, but is less common in Scotland. Another kind is known in Scotland by the name of *Cherry-coal*, and is of an open burning quality, and during its combustion, which is more rapid than the caking coal, it gives out a brisk flame, and a great deal of heat.

2. The *rough*, or *roch coal*, is of a black colour, but less bright than the Newcastle coal, burns freely, and, when pure, leaves a small proportion of ashes. Some kinds of this coal are of a cubical or diced form,

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and are also denominated cherry coal, and many of them are hard and strong, affording large masses in working. This kind of coal is abundant in Scotland, as well as in some parts of England.

3. *Splent*, or *stone-coal*, sometimes also called slate-coal; from its lamellated or slaty structure, burns freely with a strong flame, and much smoke, and produces a considerable proportion of white ashes. This variety of coal is very hard and strong, and is broken with difficulty across the strata, but it divides easily into broad flags. One kind of this coal, which is of a clear glossy black colour, is called in Scotland, *run splent*, because it seems to be run or cemented together, and the lamellated structure is less perfect, so that it divides with more difficulty.

4. *Cannel coal*, is so called from its property of giving out a bright flame in burning, and from being employed in many parts of the country as a substitute for candles; is of a black colour, with little lustre, of a slaty structure, and a conchoidal fracture, and in burning it generally leaves a large proportion of white ashes. It is susceptible of a fine polish and is sometimes formed into various trinkets and utensils. This variety of coal is not uncommon both in England and Scotland. Sometimes it forms an entire bed of itself, as at Wigan in Lancashire, where a bed of cannel-coal, of four feet in thickness, is wrought, and sometimes it forms part only of another bed of coal. In some parts of Scotland this variety of coal is called *parrot-coal*.

5. *Culm*, or *blind coal*, is of a clear glossy black colour, and has somewhat of a metallic lustre; it kindles with difficulty, but when fully ignited burns with a clear strong heat, and without smoke or flame. It seems to have a portion of sulphur combined with it, for in burning it emits a disagreeable suffocating vapour. This kind of coal is not very common, although it is abundant in some places. The Kilkenny coal of Ireland is of this nature; the stone-coal of Wales possesses the same quality; and an extensive bed of blind-coal has been long wrought at Riccarton in Ayrshire, in Scotland. This kind of coal answers well for drying malt.

6. *Bovey coal* derives its name from the place where it is found, near Exeter, in England. It is met with also in different parts of the world, and generally in alluvial soil. The surturbrand of Iceland is a coal of the same nature. This kind of coal exhibits all the appearance of wood impregnated with bitumen. The fibrous texture, and even the flexible property in many cases remain. It burns with flame, but gives out a disagreeable odour.

Dip and rise.—Coal, and its accompanying strata, are rarely deposited in a horizontal position; they are usually distributed with different degrees of inclination, forming, in some cases, nearly a right angle with the horizon; sometimes an angle of 45 or 50 degrees, as in the edge-coal seams of Mid-Lothian in Scotland, and approaching in other cases nearly to a flat position. When the strata of coal have some degree of inclination, the particular position of any part of the bed of coal in the line of its inclination is denoted by the terms *dip and rise*. The lower part of the bed from any point is said to lie to the *dip*, and the higher part is to the *rise*. A line drawn at right angles to the inclination or the dip and rise, is called the line of bearing, and this line, if the position of the coal be fair and uniform, must be obviously parallel to the horizon.

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Dislocation of coal strata.—The strata of coal seldom preserve the same uniform position to any great extent; they are subject to disturbances and dislocations of different kinds. Excepting near the termination of a coal field, where a new series of rocks commences, the thickness of the bed of coal is not subject to great variation; but dislocations of the strata, where one portion of the field is depressed, and another portion is elevated, are not uncommon. In some of these dislocations, the coal strata are merely separated from each other, without the intervention of any foreign body, and in the language of the workmen are called *slips* or *hitches*. But in other cases, besides one part of the strata being elevated, and another part depressed, some foreign body intervenes, forming a separation between the different parts of the disjointed strata. In such cases, the interposed substance is denominated, in the language of the miners, a *dyke*.

These dykes are composed of various materials, and have various degrees of thickness and extent. When they consist of the basalt or common whinstone of Scotland, they are known in that part of the kingdom by the name of whin-dykes.

It is of material consequence to the miner to be well acquainted with the relative position and effects of dykes or vertical strata which traverse a coal-field; for although the strata on one side of a dyke be quite fair and regular, if the workings be continued through the dyke, the same strata will not be found on the same plane on the other side. The whole range of the strata is in many cases either elevated or depressed. As these dykes are seldom exactly in a vertical position, the elevation of the strata takes place on that side on which the dyke forms an acute angle with the horizontal strata. If, then, in working a coal mine, it shall appear that the angle formed by the dyke with the plane of the stratum of coal, is an obtuse angle, the strata on the other side of the dyke will be found elevated; but if, on the other hand, the same angle be acute, the strata on the other side will be found depressed; and it appears from pretty general observation, that the extent of the elevation or depression is in proportion to the thickness and greater or less inclination of the dyke. In small dykes, the height of the elevation, or the depth of the depression, reaches only to a few feet, or to a few fathoms, but where the dyke is of great thickness, the amount of the elevation or depression exceeds twenty, forty, and in some cases, even sixty fathoms.

In the greater number of cases, where a dyke which traverses the strata of coal has produced a dislocation, the whole of the concomitant strata are also elevated or depressed; and when they are discovered on the other side of the dyke, whether elevation or depression has taken place, they are generally found to have the same relative position to each other, the same inclination to the horizon, and the same qualities as before. It has sometimes happened that the coal strata which have suffered a dislocation and elevation from one dyke, have been again dislocated and depressed by another; and when the dykes are nearly of the same thickness, and have an opposite inclination, the coal and its accompanying strata on the opposite sides are again restored to their former position.

But it appears that a dislocation of the strata is not an invariable consequence of their being traversed by a dyke or vertical stratum. Sometimes, although it is suspected more rarely, the strata on both sides of a dyke continue fair and regular in the same plane, and discover no perceptible appearance either of elevation or depression; and it might be worth while to inquire whether those whin dykes which are accompanied by a derangement of the strata, are distinguished by any peculiarity of character from those which seem to have produced no dislocation.

In most cases, where a whin dyke traverses the strata of coal, the coal, as it approaches the dyke, is not only broken down, compressed in its bed, and mixed with small fragments of the contiguous strata, but, being entirely deprived of the bituminous part of its composition, is totally changed in its qualities, and is altogether unfit for the purpose of fuel. According to the language of the miner, it is in the state of *foul* coal, or, as it is called in some parts of Scotland *humph coal.* In this state the coal usually continues to some distance from the dyke. When the dyke is small, the extent of the foul coal on each side is trifling, but in dykes of great thickness the extent of the foul coal is very considerable. From some information which we have received from practical miners, the extent of the foul coal on each side of a dyke is nearly equal to one-half of its thickness; and if this statement be correct, the whole extent of foul coal on both sides of a dyke is equal to its thickness.

" Vertical strata, or dykes of sandstone," says Dr Millar, " are sometimes met with traversing coal strata; and in one instance of this kind, which I had an opportunity of examining, a very considerable dislocation of the strata has been produced, but no change has taken place in the nature and qualities of the coal on one side of the dyke. On the contrary, the coal on that side continues as pure and clean, where it comes in immediate contact with the dyke, as in any other part of the field. The instance now alluded to is near Edgefield, in the Loanhead coal-field, about six miles south of Edinburgh. A dyke composed of sandstone, black blaes and ironstone, or nearly of the same materials as the strata which accompany the coal, traverses that coal-field from north to south, and throws the coal no less than 60 fathoms out of its former line of bearing. The extent of the foul coal on the west side of this dyke, is from 10 to 20 yards in some of the seams, but on the west side of the same dyke, the coal is found clean and fair. Similar instances of the same thing, I have been assured, are met with in the same field." *Williams' Mineral Kingdom, 2d Edition.*

SECT. II. *Progress of working Coal.*

It is supposed that coal was first wrought in Britain about the middle of the 13th century. Investigating this subject, Mr Arnot, in his history of Edinburgh has the following remarks.

" As the use of coal claims our attention, both by reason of its being the most valuable species of fuel hitherto discovered, and also an article of extensive and advantageous commerce, we hope a short digression concerning its introduction will not be considered as impertinent. We enter upon it the more willingly, because we are fully persuaded that the use of coal was first known in the period we have described, and that the date of its origin may be brought within a very narrow compass."—" Necessity is said not unaptly, to be the mother of invention. Had our remote ancestors known that a valuable inflammable substance was lodged under ground, the abundance of fuel which wood and turf afforded, would naturally prevent them from digging into the bowels of the earth for that with which its surface so amply supplied them.

" Even when wood became very scarce, at the distance of several centuries after the discovery of coal, the manner of working it was extremely rude; the progress and extent of the use of it, slow and limited. The statutes enacted by the Scottish parliament, and the patents granted by the kings, display their ignorance in working coal, set forth strongly its decay, and guard anxiously its preservation. In the beginning of the 16th century coal-smoke was deemed very pernicious; and, even in the end of it, the use of coal in making iron was hardly known in Scotland. If the progress in the working of coal was slow, its first discovery was not very remote. Coal, certainly, was not discovered in the middle of the 12th, and it was as certainly known in the beginning of the 13th century. In the *Leges Burgorum,* which were enacted about A. D. 1140, a particular privilege is granted to those who bring fuel into boroughs. Wood, turf, and peats, are particularly mentioned; but with respect to coal there is a dead silence. But in the year 1234, Henry III. of England renews a charter which his father had given to the inhabitants of Newcastle; and in this renovated charter he grants, upon their supplication to the persons in whose favour the charter was conceived, licence to dig coals upon payment of L.100 a year, which is the earliest mention of coal in the island. By the end of the 13th century, the use of coal was so much advanced, that it was frequently brought by sea-carriage from one port to another. But the first mention that is made of coal in any charter in Scotland, is in a grant executed A. D. 1291, in favour of the abbot and convent of Dunfermline, of the privilege of digging coal in the lands of Pittencrieff in the county of Fife.

" Æneas Sylvius, who afterwards assumed the purple under the name of Pius II. visited this island about the middle of the 15th century. He relates that he saw in Scotland the poor people, who in rags begged at the churches, receive for alms pieces of black stone, with which they went away contented. This species of stone, (says he,) whether with sulphur, or whatever inflammable substance it may be impregnated, they burn in place of wood, of which their country is destitute.

" And Boetius in his Description of Scotland, his native country, written in the beginning of the 16th century, says, " There are black stones also digged out of the ground, which are very good for firing; and such is their intolerable heat, that they resolve

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and melt iron, and therefore is very profitable for smiths and such artificers as deal with other metals; neither are they found any where else (that I know of,) but between the Tay and Tyne, within the whole island.'

"In China, it is probable that coal was discovered long before it was known in the western world.

"About the middle of the 13th century, a noble Venetian, in his description of China, observes, 'That through the whole province of Cathay, certain black stones are dug out of the mountains, which being put in the fire, burn like wood; and when kindled, they continue burning a long time, in so much that, if they are lighted in the evening, the fire will keep alive during the whole night. Many use these stones although they have plenty of wood, the consumption of fuel in stoves being very great.'

"It is curious to observe the similarity with which Marcus Paulus, Æneas Sylvius, and Boetius, speak of the same matter."

But it is supposed that coal was wrought in the vicinity of Newcastle in the time of the Romans, and that a coaliery was established not far from Benwell during the period in which that people lived in Britain. In the year 1239, Henry III. granted to the freemen of Newcastle the right to dig coal in the neighbourhood; and seven years after that time, it is said, it first obtained the name of *sea-coal*. In the reign of King John, the coal trade made rapid progress; but although coal was found to be the best kind of fuel, it appears that its use was prohibited in London, by a royal proclamation, which was issued in 1306. In 1351, a licence was granted by Edward III. to the burgesses of Newcastle, to dig coals and stones in a place called Castle Field, without the walls; and about the same period, a coaliery at Elswick near Newcastle was demised to Adam Colewell, for five pounds of yearly rent. In the year 1421, the coal trade had become of such importance, that acts of parliament were made for its regulation; and in particular it was directed by one which was passed in that year, that all vessels carrying coals should be measured by commissioners nominated by the king, and should have their burden marked upon them, that his majesty might not be defrauded of his duty of twopence per chaldron by false measurement.

A lease for the period of eight years, of two coalpits at Elswick, was granted by the prior of Tynemouth in 1538 to Christopher Midford, at the annual rent of L.50. The price of coals at this time at Newcastle was 2s. 6d. per chaldron, and at London about 4s. In 1582, Queen Elizabeth obtained from the bishop of Durham a lease of the manor of Gateshead and Whickham, with the coal mines, common wastes and parks, for 99 years, at the annual rent of L.90. This lease, which is commonly known by the name of the *grand lease*, and which occasioned an increase of the price of coals, was first assigned to the Earl of Leicester, the queen's favourite, and afterwards to the famous Sutton, the founder of the Charter-house in London. The price of coals then rose to 6s. per chaldron. An assignment of the same lease, for the sum of L.12,000 was made by Mr Sutton to Sir William Liddle and others, for the use of the mayor and burgesses of Newcastle. Coals then advanced in price to 7s. afterwards to 8s. and in 1590 to 9s. per chaldron. During the time of Queen Elizabeth, and the four succeeding reigns, various acts and regulations were made by Parliament relative to the coal trade of Newcastle. In the year 1648, the price of coal in London was so high, that, it is said, many of the poor actually died for want of fuel. A complaint was made against Sir Arthur Hazlerigg, governor of Newcastle, for imposing a tax of 4s. per chaldron on coals; and the year following the matter was taken up by the house of Commons, and an investigation directed to be made into the claim of 1s. per chaldron, and in what way this claim might be obviated.

In the year 1655, the price of coals in London exceeded 20s. per chaldron; and at this time 320 vessels appear to have been employed in the coal trade upon the river Tyne, each of which carried annually 800 chaldrons. An act of parliament was made in 1667, by which a duty of 1s. per chaldron was granted to the lord mayor of London, to enable him to defray the expence of rebuilding the churches and other public edifices which were destroyed by the great fire of the preceding year; but this being found insufficient, it was raised to 3s. per chaldron, and to continue for 20 years. In 1677, Charles II. granted to the duke of Richmond a duty of 1s. per chaldron on coals; and the right to this impost continued in the same family till the year 1800, when it was purchased by Government for the payment of L.19,000 annually to the duke and his heirs. The duty on coal imported into London amounts at present, it is said, to the annual sum of L.25,000.

Such is a short sketch of the coal trade of Newcastle till it rose to its present importance. The following is a statement of the quantity of coals exported from the river Tyne, for a period of four years; and it will show to what an extent it is now carried.

Years.		Coastwise.	Over Sea.	Plantations.
1802	Chal.	494,488	41,157	2,844
1803	ditto	505,137	42,208	1,516
1804	ditto	579,929	48,737	3,852
1805	ditto	552,827	47,213	2,360

But it must be observed, that the above is exclusive of the coal exported from the harbours adjoining to Newcastle, as from Sunderland, the exports of which amount annually to 300,000 chaldrons, besides a considerable quantity from other ports. It is also exclusive of the quantity consumed in the town and neighbourhood.

To form a probable conjecture of the length of time during which a supply of coal may be obtained from the rivers Tyne and Wear, a calculation has been made according to the following data. 1. That the seams of coal which are now wrought in Northumberland and Durham may be estimated as equal to a seam or bed of 20 miles in length, and 15 in breadth; 2. That this seam may be taken on an average at $4\frac{1}{2}$ feet in thickness; 3. That one-sixth of the above extent of coal must be deducted for pillars, which are left in the mines; and, 4. That a cubic yard of coal is equal to 1 ton or 20 cwt. according to the experiments of Dr Watson.

The consumption of coal in London is estimated at

	London Chald.
at - - - - -	900,000
Coastwise - - -	700,000
Foreign consumption - -	250,000
Consumed at Newcastle, Shields, and Sunderland - - -	450,000
Total annual consumption of coal from the rivers Tyne and Wear, -	2,300,000

The number of tons in the above quantity, taking the chaldron at 27 cwt. is 3,100,000, and as a ton weight of coal occupies in the earth the space of one cubic yard, the number of entire yards in the square mile amounts to - - 3,097,600

The beds or seams of coal being taken on an average at $4\frac{1}{2}$ feet in thickness, increases the above number of entire yards in the square mile, by half the number of square yards, to -	1,548,800
And hence the square mile contains of cubic yards, or tons of coal, -	4,646,400
Deduct one sixth for pillars, waste, &c.	700,833
Tons of coal obtained from a square mile	3,945,567

From the above calculation, it appears that a square mile is sufficient for the consumption of $1\frac{1}{3}$ year; and taking the area as already stated at 20 miles long and 15 broad, amounting to 300 square miles, there is a source of consumption for 360 years.

The above statement of the probable duration of coal in the counties of Northumberland and Durham is given according to the data laid down by Dr Macnab, in his Treatise on the Coal Trade; but it must be observed, that although the district of coal may be estimated at 300 square miles, yet as a considerable part has been wrought out, and no account of this taken, the calculation must turn out erroneous; and if to this be added the increase of the annual consumption, which there is good reason to think may be considerable, the period in which the whole coal of this district will be consumed must be greatly abridged. According to other calculations, indeed, the extent of the coal district in Northumberland and Durham is estimated at 25 miles long and 8 broad, making the superficial extent only 200 miles. But the calculation alluded to proceeds on the supposition that the whole mass of coal in that extent may be estimated at 3 yards thick; in which case the duration of the coal, at the same annual consumption, will be 400 years.

Of the calculations now referred to, it may be observed, that they are to be considered only as an approximation to a precise statement of the quantity and consumpt of this valuable mineral.

Chap. II. Methods of searching for Coal.

The methods of searching for coal in places where it has not been actually wrought, may be reduced to two; and these depend on the appearances and nature of the strata where an opportunity of examination is offered, and upon the indications of the nature of the strata obtained by boring; or it may be expressed more generally by the combined information derived from both these methods of proceeding, which may be considered in separate sections.

Sect. I. *Appearances of the Soil and Strata.*

From the natural desire of holding so valuable an acquisition as a good stratum or seam of coal in a populous district, where the demand and consumpt would be certain and considerable, one proprietor is disposed to conclude that he is possessed of this invaluable advantage because his next neighbour is in actual possession of so desirable an object. If no change or disturbance of the strata have taken place, the contiguity of two properties renders such a conclusion a fair and legitimate inference; but if any dislocation of the strata appear, or if any change seems to have been produced in their inclination, arrangement, or thickness, it would be extreme rashness to conclude that the same, or even any seam of coal is to be found, merely because it exists in the adjoining field. It may be remarked, in general, that no coal is to be expected among those rocks which belong to the primitive class,—among those rocks which abound with metallic veins, as lead or copper,—among rocks which exhibit no regular stratification,—or among extensive beds or masses of limestone, red sandstone, or even very thick masses of whitish sandstone, resembling in its appearance that which accompanies coal. Such masses of sandstone, of which excellent examples may be referred to at Craigmillar, Hailes, and Craigleith, in the vicinity of Edinburgh, seem to cut off the strata of coal as effectually as any series of primitive rocks. It would be in vain, therefore, to search for coal in such situations.

In searching for coal in places where none of the rocky strata is visible, some indications, although not of the most certain kind, may be obtained by careful observation of the alluvial soil; and for this purpose it is necessary to examine with attention ditches, pits, and wells, where it has been cut through. It is not unusual to find small fragments of coal in the loose soil, in beds of clay, intermixed with the gravel, and sometimes in beds of sand; and in the latter case it is curious to observe, that the fragments of coal are often distinctly arranged in their strata, from which it would appear that they had been conveyed by water, and thus regularly deposited along with the sand. In such situations, small pieces of every kind of coal have been found. But whatever may be the origin of these fragments of coal, whether they be the remains of the rocky strata which once existed on the same spot, or have been washed away from more distant strata, such appearances are by no means to be considered as certain indications of coal; but, in examining the alluvial soil, if the small fragments of coal appear to be deposited in somewhat of a regular or uniform manner, that is, if the fragments are only found in one particular line, or are more abundant in that line, some encouragement is thus offered to continue the research, for it may be supposed that they proceed from a stratum of coal, the out-crop of which, as it approaches the surface, as well as the accompanying strata, has been broken down and mixed with the soil. In some cases a thin stratum of coal-dust has been the first indication of the commencement of a valuable seam of coal; but such appearances, however flattering, must be entirely superseded by more certain indications, which are to be found in the examination of the rocks, either by digging or boring.

Where the rocks are visible to any considerable thickness, those who are familiar with the nature and appearances of the strata which accompany coal, will be able to decide with more certainty whether it be prudent to incur any great expense in prosecuting the research. But it must be observed, that although the most favourable indications are presented by any series of rocks, and even although thin seams of coal may be discovered, it is not to be concluded that a workable bed will be found at a greater depth; it is not, indeed, even probable that such a seam of coal may exist; but it can only be ascertained by its actual discovery.

Sect. II. *Boring for Coal.*

As it very generally happens that coal strata are distributed in flat countries, an ocular examination becomes, in such circumstances, impossible; and as it is of much importance to acquire an accurate knowledge of the nature and thickness of the beds of coal which are expected, before the expensive operations of sinking shafts are attempted. Such information is often obtained by boring. No particular directions can be given for conducting the operation of boring, without going into unnecessary minuteness; but it ought to be strongly recommended to those at whose expense the operation is conducted, as well as to those who are engaged in it, to employ the utmost precaution and attention. How essentially requisite this recommendation is, the following cases recorded by Dr Millar, in his edition of *Williams's Mineral Kingdom*, afford ample illustration: "The apparatus," he observes, "in common use for this purpose, which is well known to miners, is not always to be depended on for the accuracy of the results which it affords. This uncertaintainty arises sometimes from the unskilfulness or fraud of those employed in the operation, and sometimes, perhaps, it is entirely owing to unintentional error. About twenty years ago, (written in 1810,) a bore hole was put down in a coal field in Mid-Lothian. The operation was conducted by experienced workmen, and the report announced, that a bed of coal of only a few inches thick was penetrated, where one of considerable thickness was expected, and where an excellent seam of six feet thick was afterwards discovered, and has continued for some years to afford an abundant produce.

"Not long since, a professed discoverer of coal undertook to search for that combustible, by boring in a district of Ayrshire, where it would have been an invaluable acquisition. In the progress of his labour, the inhabitants were flattered with the most certain hopes of success; and at last, to their great joy, they were informed of the welcome discovery of the object of research. Contributions to defray the expense, and to reward the discoverer, which were formerly granted with a sparing hand, were now liberally made; and specimens of the coal, in the form of powder, in which state it can only be obtained from the nature of the operation, were exhibited. But as the fraudulent are not always consistent, some deviations in the narrative of his proceedings excited suspicion, and led to an investigation; in the course of which it appeared, that the coal produced in the day was secretly conveyed into the bore hole during the night. It must be noticed, that the rocks selected for the scene of the above operations are red sandstone, in which coal can never be expected.

"An apparatus for boring has been proposed by Mr James Ryan, of Queen's county in Ireland; the judicious application of which may certainly correct the errors, and prevent the frauds now alluded to. This instrument, for the use of which Mr Ryan has secured the exclusive privilege by patent, is an auger with teeth, something in the form of the trepanning instrument of surgeons. Its superiority over the boring instrument in common use consists in this, that a solid cylinder or core of the rocks through which the instrument passes, can be obtained; and in this way their nature and thickness can be more precisely ascertained, than when they are reduced to the state of powder by means of the chisel of the old instrument. Cores or cylinders from 2 inches to 2 feet in diameter, and from 6 inches to 5 feet in length, according to the dimensions of the borer employed, can be formed, and they are extracted from time to time by means of a pair of self-closing tongs. But this is not the only advantage of Mr Ryan's apparatus. If the cylinders produced be not of too small diameter, not under 6 or 8 inches, by placing them, after they are brought up, in their relative position with respect to the points of the compass, an accurate knowledge of the inclination of the strata may be acquired. After the core is formed by the auger, and the borer is drawn up, another instrument is introduced for the purpose of marking the top of the core with two lines at right angles to each other. One of the lines may be thicker than the other, or be otherwise distinguished to denote north and south; and the impression being made to correspond with the cardinal points, shows exactly what was the natural position of the cylinder, and consequently of the whole stratum. This is a most important piece of information in directing the future operations of a coal-field which has been hitherto unexplored.

"Mr Ryan's boring machine has been much approved of by the Dublin Society, the Board of Agriculture of London, Mr Dickinson of the Seaton Iron Works, near Workington, and Mr Curwen of the same place, who have either seen the machine actually at work, or the cylinders produced by it. The following is the account of its operation by Mr R. L. Edgeworth, in an experiment made in presence of that gentleman: 'Two men,' he says, 'relieved from time to time, cut a truly circular hole $5\frac{1}{4}$ inches in diameter, through a block of hard limestone, leaving a *core* a little taper of $4\frac{1}{2}$ inches diameter, and $6\frac{3}{4}$ in length, which core is now in my possession. It is as true and as smooth as if turned and polished in a lathe, and the under surface shows exactly the fracture by which it was detached from the block at bottom.

"By this contrivance mines may be ventilated at small expense; the specimens of strata that are bored through may be brought up whole and unmixed; no deception can take place; and not only the dip, but the fracture, lap, and accidents to which each stratum is liable, may be determined at any depth. True vertical and horizontal sections may be previously obtained of any spot where it is proposed to sink shafts; and the subterraneous topography of a whole district may be laid down upon a map with great confidence, before any great expense is hazarded on mere speculation."

"But in justice to a very ingenious man, Mr Scott of Ormiston in East Lothian, it must be observed, that an instrument exactly of the same nature has been long employed by him for the purpose of extracting a core or cylinder of the coal, and thus ascertaining its thickness. About a year ago I had an opportunity of seeing the individual instrument used by Mr Scott. I do not know, however, that it was ever applied to rocks in general, or in any other way but to determine the thickness of the coal when it is discovered by the common apparatus. In this general method of using the new apparatus, therefore, Mr Ryan's exclusive privilege may perhaps be considered as perfectly entire."

Chap. III. Operations for obtaining Coal.

Having ascertained the existence, and determined, in some degree, the arrangement or distribution of coal, our next and chief consideration is how to get possession of it. Sundry and serious labours are necessary for this purpose, of which it is now intended to give a general view. It seldom happens that strata of coal are found so dry as to admit of being immediately wrought; the first operation required, therefore, is that of draining it, or, in other words, diverting off those springs and feeders of water, as they are frequently called, which would materially impede the workmen, if not endanger and utterly destroy them. The technical term usually applied to this preparatory operation, is that of

Sect. I. *Winning the Coal.*

This is effected commonly in one of two ways. Where a difference of elevation, and the peculiarities of the situation admit of it, a very ready mode of laying the coal dry, is that of cutting a canal in the lower grounds, through which the water may be drawn off. A canal of this kind is indiscriminately denominated a *water-level*, *day-level*, or *sough*, this last term prevailing most in some of the coal-fields in England.

It may be commenced at the position thought most eligible, in the manner of an open ditch, about three feet wide, and carried on till it be about six or seven feet deep from the surface, when it must assume the form of a mine proceeding through the solid strata in the direction of the coal. Its bottom ought to be kept constantly of the same level, and, in general, it is proper to defend the sides, and support the roof with wood, stone, or bricks, in order to counteract the pressure of the adjoining materials, and guard against the disintegrating effects of the atmosphere. If carried on to a great length, it is evident the enclosed air will become unfit for farther respiration; and accordingly, for the sake of the workmen, as well as to facilitate the removal of the stones and rubbish, it is necessary that small pits be sunk from above; and from the bottom of these, it is also occasionally useful to run square boxes made of wood, closely jointed together, along the top of the mine to its extremity. These *air-boxes*, as they are called, promote a tolerably free circulation, and carry off much of the damp air which is usually met with in such excavations. In place of air boxes thus applied, what are called for a similar reason, *wind-gates*, or *air-gates*, are sometimes adopted. These are floors of boards, closely put together and coated with clay to stop any cracks, laid a few inches above the stream of water at the bottom of the sough or mine, and to a certain degree answer the purpose of supplying fresh air in the *fore-field* of the sough, whilst the heated and vitiated air escapes along the roof to the outlet. In some instances, large bellows have been employed to force air into the sough; fire places have also been constructed over the mouths of the air-trunks, in order to abstract the foul air; and various contrivances have been suggested, and had recourse to for the same purpose, with more or less efficacy. An account of some of the most useful of these is given in the 35th vol. of Tilloch's Philosophical Magazine.

The operation of a day or water-level, it will easily be understood, is confined to those portions of the coal-field which are more elevated than itself, and hence can seldom or ever be sufficient for winning all the coal. Besides, the distance to which it might be requisite to extend it, and the difficulty of cutting through the strata in its course, owing to their excessive hardness, present formidable objections in the way of expence to such a process, which, in many cases, no supposeable or at least attainable quantity of coal could remunerate. It was, notwithstanding, the practice more generally adopted, previous to the introduction of the steam-engine, by which the interests of the miner have been so essentially promoted. Some idea of the magnitude, nature, and cost of these *winning levels*, if the term may be applied to undertakings, according to all accounts, found so unprofitable, will be conveyed by selecting a few examples from Mr Farey's enumeration of the more considerable within the limits of his map of Derbyshire. That of Cromford, driven through various beds of limestone and toadstone, two miles long, cost L.30,000; Hillcar, about three miles long, through shale and lime, cost L.50,000, and boats were used in it; Mearbrook, $1\frac{1}{2}$ mile long, through grit, shale, and lime, begun in 1773, and continuing in 1811, had *then* cost more than L.45,000, and also required boats; Stoke, two miles long, through shale, lime, and toad-stone, cost L.35,000, and has a shaft 306 yards deep upon it; Yate-stoop, $2\frac{1}{4}$ miles long, through shale and lime, was 21 years in driving, and cost L.30,000.

Where the surface of the ground is nearly horizontal, it is obvious that a day-level or sough is impracticable, or could afford no benefit; and other considerations, already alluded to, may render such an operation too laborious and expensive to be expedient. Recourse must be had, therefore, to the second and more generally applicable mode of winning, by means

Operations. of the steam engine. The employment of this powerful instrument has almost totally superseded the wooden-pumps formerly so common, and which, under a variety of forms, were used either by themselves, or as additions to the day-level. Some of these pumps were worked by men, others by horses, and a few in different districts were driven either by windmills or water-wheels. Of those nearly exploded methods of carrying away water from the coal, it is unnecessary, for any practical purpose, to take farther notice. We proceed, therefore, to speak of the application of the steam-engine. The advantage of this agent consists in its furnishing a sufficient and easily managed power for raising up and consequently conveying away water from the coal beds.

In order to reap the greatest benefit from it, it is proper, if circumstances allow, to fix upon the deepest part of the coal, or as near towards the dip as possible, for its position, as this will necessarily drain the largest portion of the field. It is often highly serviceable, also, where it can be done, to connect a day-level of moderate extent with the engine-pit, by which canal the water can be taken off, without being raised so high as the surface of the ground, and consequently a saving of power is effected. The operation of making an engine-pit is called *sinking*, and is generally performed by the same persons who practise boring. It comprehends the removal of the superincumbent soil and loose gravelly beds, which is done in the usual way of digging, the perforation or separation of the more solid rocks, which sometimes requires the aid of gunpowder, and the lining of the sides of the shaft or pit, by wood or other material, in order to prevent its being choaked or running in. Where timber is employed for this last purpose, the shaft is usually made square, or at least with parallel sides; but often, and more especially if brick or stone is thus applied, the form is either circular or oval. The common width is between 7 and 9 feet. If any springs or feeders are encountered in the process, within a few fathoms from the surface, it is proper to cut trenches in such a manner round the opening, as will carry off the water, so that the workmen may not be incommoded by it. Sometimes the nature of the soil and adjoining strata is so loose and open as to require these conduits to be partly lined with wood. At the depth of 15 or 20 fathoms, if necessary, a cistern may be fixed for collecting the product of these feeders, into which the first set of pumps is to be placed; a similar practice may again, perhaps, be required, before reaching the coal; and after getting down so far, it is proper to continue sinking for a few feet, and to work out some of the coal from the dip-side of the pit, so as to leave a sufficient space for the accumulation of the water at such time as the engine is not going.

In the case of shallow shafts, at least in some districts, a kind of rope-roll, with winch-handles, called a *turn-beam*, *turn-tree*, or *windlass*, and worked by men, is erected for the purpose of lifting up the water and sinking-stuff. Still more frequently, this is accomplished by means of a *horse-gin*, having a rope-barrel or drum from which the mine-ropes are conducted to pullies placed over the shaft, and so applied to them, that while one end, having a barrel attached to it, descends, its antagonist, with its corresponding appendages, ascends. Of late years both of these modes of raising the water, &c. have very commonly given way to a small *steam winding-engine* or *wimsey*. The pumps mostly used in the present day are made of cast-iron in separate portions of a certain length each, and screwed together so as to form a pile or pillar of hollow tubes. Where the shafts are deep, these pumps are arranged at different heights, according to the position of the cisterns already alluded to; and the pistons or rods, which are made of timber, descend separately from the engine-beam to their respective pumps. Various modifications of the pumps, and their accompanying apparatus, are adopted in different places and for different objects, which need not be specified in this place. It is a rule in sinking, to place the lower lift of pumps in the lowest hole at the bottom of the shaft; and, accordingly, when a new hole has been made, they are allowed to sink in it; for which purpose, it is usual in many cases, to have the lowest length of the pump moveable and attached to a windlass. New lengths are added to the top of this, as the shaft is deepened, and the pump-rods are lengthened as occasion requires. Where the shaft is very deep, the lower pumps deliver their water to the cisterns above, these again to still higher cisterns, and so on till a water or day-level is reached, or, if this be wanting, till the contents be evacuated in rills or streams on the surface. The quantity of water thus discharged is often adequate to the turning of a corn mill, and is occasionally directed to some such beneficial purpose.

The operation of sinking is at times much impeded, and rendered difficult, by the occurrence of quicksands and large feeders, which require particular treatment. If the quicksand be on the surface, it is generally sufficient to make a larger opening than usual, till a solid stratum be met with, where a wooden frame is to be fixed, the outside of which is covered with wrought clay up to the top. Or occasionally, after sinking as far as is thought safe, and on a larger scale than it is purposed to make the shaft, a flat ring of timber, called a curb, and in preference consisting of oak or elm, is to be laid on the bottom, on which stones or bricks are to be built till they reach the top. The sinking is then to be prosecuted within this curb for a few feet, and the space is afterwards enlarged, when the necessary coating of timber, &c. is applied, and other measures adopted, as circumstances require. A process essentially similar to this is practised, when the quicksand presents at the depth of some fathoms from the surface. It is denominated *tubbing*, *stopping-out*, or *wedging*, and consists in the application of water-tight cylinders, either of cast-iron or timber, to the interior of the shafts, so as perfectly to prevent the exit of water. In place of this, a wall of stone, cemented with water-lime, or a *ginging*, as it is called, is sometimes built within the shaft, made somewhat larger than common, and the space behind it is rammed full of well-tempered clay. These methods are no doubt very expensive, but are so effectual, that in many cases water has been stemmed out or kept back by them for a height of 60 or 70 fathoms. So conducive to the prosperity of a mine is its dryness, that every precaution ought to be used, and no expense spared in order to secure it.

Sect. II. *Of Working the Coal.*

When, by means of a day-level, or an engine-pit, or both combined, with or without a variety of subsidiary additions, we have succeeded in obtaining command over the water, we proceed to the operations of driving a mine into the coal, and sinking a pit, for the purpose of drawing up its product.

Two cases may be supposed requiring distinct consideration. Either our level has been driven on to the bottom or lower side of a seam of coal, or we have sunk a shaft to its floor or sole. In the former, whenever a shaft or coal-pit is sunk at the proper place, a stream of cold air rushes in by the level and ascends the shaft; and, generally speaking, the work of mining and removing the coal may be immediately commenced. In the latter case, it is necessary to sink a second shaft, or *bye-pit*, and to connect it with the first, when a circulation of air will commonly be effected, sufficient to enable the workmen to advance in their labours; though at times this does not happen, and it consequently becomes necessary to suspend a fire-pan in the bye-pit, or to erect an elevated cone over it, like that used in potteries, for the purpose of increasing the draught of air from the shaft. The next step, after accomplishing a free circulation in either case, is that of cutting a water-level in the coal, or, in other words, making a passage each way for the transit of the water, and it ought to have a small inclination towards the pumping-shaft or the sough. This level may be straight, whatever is the dip of the coal, provided the strata be regular, and there be no dikes or troubles in them. But this water-level can seldom be pushed far for want of air, unless a parallel or counter-level be at the same time carried on, at a few yards distance from it, up the inclination of the coal, so as to admit of a circulation by the driving of holes between them, which is performed as often as is necessary during the progress of the work, care always being taken to close up those communications which were previously made, when new ones are opened in advance. In the case of deep pits, and where the ground requires very expensive sinking, it is common enough to divide the engine-shaft, which is then made larger than usual, by a partition of wood extending from top to bottom. By this contrivance, without a bye-pit, a circulation of air is tolerably well secured,—one of the areas being employed for the pumping apparatus and the descent of pure air, and the other for the drawing up of the coals, and the escape of the foul and heated air. There are examples even of shafts being divided into three and four compartments; but, on the whole, those of two are to be preferred, and have been found so efficient that there are instances of mines being wrought by means of them to the distance of two miles from the bottom of the shaft. But, in these cases of double pits, the steam-engines employed are of the best construction, and of an hundred horse power or upwards. Where a steam-engine is employed, it is proper to sink the first coal-pit somewhat to the rise of the engine-pit; and, generally speaking, not exceeding forty yards from it. In this manner the water which collects during the time of the engine stopping, is prevented from impeding the workmen, and we obviate some of the labour and expence attendant on driving a mine at a distance.

Thus far as to the mode of preparing for the removal of the coal. We have now to examine, with the greatest care, the nature and qualities of those strata which lie above the coal, in order to determine what width of opening may be made into it, without hazarding the fall of the roof. In some cases, unfortunately, the superincumbent materials are so tender and fragile, that it is quite unsafe to attempt to mine; in others, it is advisable to leave the very best portions of the coal as a roof, rather than to work it at the manifest risk of a depression or down-come. But suppose our examination results so far in a satisfactory way, that we resolve on advancing, we have next to fix on the lengths of the banks or works which can be opened at one time; and also on the directions which they ought to have with respect to the water-level, and its parallel counter-level, or *working-gate*, as it has been termed. The lengths must bear proportion to the demand, and the number of people employed; and the directions must be regulated by the longitudinal joints or partings, backs or *slines* of the coal, as they are variously termed; for unless they do so, it will readily be understood from the former description of the conformation of the coal strata, the difficulty of getting it out will be vastly augmented, and it will be broken small in the operation.

Different modes of working the coal, or taking it out, have been adopted in different countries, and at different times. The earliest miners, it would appear, removed as much of the coal as they could with safety at one working only, leaving the pillars for their support of the roof so small as generally to give way under the weight of the incumbent strata, by which means a very large portion of coal was entirely and irremediably lost. After this, succeeded, particularly in Scotland, what has been denominated the *narrow way*, and which must be allowed to be a material improvement, as it respects both safety and profit. It consisted in cutting passages through the coal longitudinally and across,—pillars of coal of a certain magnitude, according to the quality of the coal and the nature of the superincumbent strata, being left at certain distances for the support of the roof, till the mine was pushed as far as intended. This formed the *first working;* after which these pillars themselves, or at least great part of them were taken down, beginning at the greatest distance, and the roof and strata above it allowed to sink down and fill the vacancy. This was called the *second working.* The quantity of coal taken away by this method varies according to different circumstances. Where the roof and bottom as well as the coal are strong, and the pit about thirty fathoms deep, it is said that two-thirds or even three-fourths may be removed at the first working, and of the remaining third or fourth, a considerable portion is obtained in the second working. In less favourable cases, as where the roof is tender, and the coal soft, a much less quantity is wrought out, perhaps not more than one half, or even a less proportion. The quantity which it is safe to attempt removing, must be determined by a very cautious examination of all the particulars in the case, and these also must regulate the size of the pillars to be left, and the dimensions of the cavities from which the coal is to be taken. Accidents have frequently happened both from want of care in ascertaining the condition of the roof and adjoining strata, and also from the imprudence of some of the workmen in lessening the size of the supporting pillars, *or robbing them,* with the view of saving themselves trouble, by bringing the coal from a greater distance. This of course is not at all unlikely to occur where the labourer is paid by the quantity he works, rather than by day's wages, the desire of gain in a great degree absorbing the apprehension, and destroying the sense of danger.

This mode, advantageous, and, if carefully carried on, tolerably safe as it is, has of late years given place in several districts to the *broad or long way,* which is more economical, and affords on the whole greater security. Several accounts of it have been published deserving attention. We prefer Mr Farey's, as given in his General View, &c. of Derbyshire, of which the following abridgment may not prove unacceptable to the reader.

A cross gate or *thurl,* as it is termed, is cut from the working-gate, at 50 or more yards from the engine-pit, and carried from 10 to 20 yards up the slope, or greatest rise of the coal; or, more frequently still, two such thurls or *Jenny-gates,* as they are also called, are made at three or four yards distance from each other, for the purpose of conducting air, and affording a double entry to the banks; other gates are now cut into the coal, branching from these, opposite to each other, and ranging parallel to the working-gates, the sides next to which are called the counter-ends, and the others the banks or faces of the work. These last vary from 5 to 100 yards in length, according to the strength of the roof, and the parallelism ofthe slines to the level.

Matters being thus prepared, the work proceeds in the following manner. A set of men, called holers, commence in the night to undermine all the bank or face of the coal, by cutting a channel from 20 to 30 inches back, and 4 to 6 high in front, which they do by means of a light sharp tool called a *pick-hack* or *maundrel,* taking care occasionally to place short struts of wood in those places where they apprehend the coal is likely to give way, in consequence of their undermining. Having completed their operations on the banks, they are succeeded by another set of men denominated *hammermen* or *drivers,* whose business it is to bring down or *fall* the coal, which they do by means of long and sharp iron wedges, applied to the face of the coal at or near the top, and driven in by large hammers, till pieces or blocks are detached, sometimes several yards in length. This is at first rather a dangerous operation, as there is little or no room for the workman stepping back to avoid the falling coal, as he afterwards can do when the banks have been somewhat wrought. A man called a *rembler* next follows, and with a hammer-pick reduces the fallen coal to suitable sizes, for the purpose of being drawn, pushed, or carried to the bottom of the drawing-shaft, whence it is elevated to the surface.

The day's work being finished by the removal of all the coal which had fallen from the bank, another set of men called *punchers* or *timberers,* enter the pit, carrying with them wooden posts of a certain size and length, which they set up in a row, fronting and nearly touching the new face of the coal, a small flat piece of wood being applied to the top of each, unless the hardness and strength of the roof render this addition unnecessary. The distance at which these posts or *puncheons* are placed, varies according to circumstances. Where the roof is bad, they are sometimes put within a yard of each other; at other times they are only required where joints are met with in the rock above; and in a few mines, such is the stability of the roof, these supports are entirely dispensed with. Things are now ready for the return of the holers and their successors in rotation, as already described. After the completion of another day's work, the punchers renew their operations, either taking down the puncheons in succession, if the goodness of the roof admit, and applying them in advance to the face of the coal, or setting up a new row if the tenderness of the roof require the continuance of the former support. In this latter case, they observe to fix the additional puncheons opposite to the openings of the preceding row; and it may not be till the third day that they find it proper to remove the puncheons which had been formerly applied, for the purpose of removing them to the face of the work. It is the number and waste of these posts which constitute a large proportion of the expence of working some mines; and this occasioned the introduction of cast-iron puncheons, which have been recently found to answer extremely well in common cases. But where the weight is apt to come suddenly down, neither these nor the other pillars are so serviceable and convenient as square pieces of wood or flat stones piled up on each other to the required height, and placed on a little elevation of loose stuff or a soft floor, which can be readily picked out, when it is proper to remove the support. In some of the mines in Scotland, it may be remarked, where the new way of working is introduced, it is usual to make the sustaining pillars of stone, either built round posts of wood, or with a hollow in the center, which is filled up with rubbish or loose materials. They are commonly erected from six to eight feet high, and at from seven to ten feet distance, according to the nature of the case; and it is usually observed, that the effect of the pressure which they have to sustain, is the diminution of their height, perhaps a fourth, or even a third part, in a short time. But, notwithstanding this rather alarming depression, it is fairly admitted by the intelligent workmen, that they have far greater security for their lives than by the former method. The advantages of it to the owner is immense, as generally speaking, seven-eights or nine-tenths of the coal are thereby raised at one working; besides, the important circumstances of the facility with which the mines may be divided into different districts, each of which may be worked out in its turn, and the practicability which the method oc-

Operations. casionally admits, of suffering the roof to close in at the extremity in such a manner as to bring down any of the superior strata of coal within the limits of working, thereby preventing those hideous openings for draining, &c. on the surface, which often so greatly disfigure the lands, where coals have been wrought on the former plan. It is necessary, however, to remark, that in order to obviate any injury of one part of the mine, by the subsidence of the roof in another, it is proper to leave a large supporting wall, or pillar of coal, between each division; and that there certainly are cases where the tenderness of the roof renders it necessary to work only very short banks, and where, of course, the benefits of the long or broad way, by which lengths of 150 yards may be cut in one face, are not so apparent or attainable. The mode of working by very short banks, or by *post and stall*, as it is sometimes denominated, besides requiring great strength of roof to support the large square, or long chambers cut into the mine, occasions much waste of coal, and has very properly, therefore, according to Mr Farey, been nearly given up in Derbyshire and the adjoining coal districts.

After the verbal description of the chief modes of working coal now given, the reader will be able to profit by the consideration of the figures Plates 50. and 51. and their corresponding explanations.

It is proper, before closing this section, to say something respecting the different modes of bringing the coal from the rooms and working places to the pit-bottom, and raising it into day-light. In many places, particularly in Scotland, whether owing to the frequency of dikes, the great descent of the strata, and consequent contractedness of the passages, or chiefly, perhaps, from a habit, which, however barbarous, it has not been thought expedient to relinquish, the task of removing the coal is committed to women called *bearers*, who carry it on their backs, to the quantity of from a hundred weight to a hundred weight and a half each. Very probably, an innovation in this degrading practice would be resisted with no less zeal by those who are most interested in it, than what has been frequently displayed by the opposers of machinery in sundry kinds of manufacture, which had previously been carried on by the hands alone. And there would in this case be an additional difficulty to encounter, as it is well known, that one great inducement for a coalier to marry young, is the certainty of his getting a bearer in the person of his wife. The men themselves, in more favourable situations which admit of it, draw out the coal in baskets fixed on four-wheeled carriages, each of which may carry four or five hundred weight at a time. Asses, mules, and horses are frequently employed for the same purpose, when the height of the passages and evenness of the bottom will allow of them. In some well managed mines, a cast-iron railway extends throughout the chief passages, having moveable railways of a smaller size, branching from them to the face of the workings, and along these, wicker baskets or boxes, placed on carriages with iron wheels, are propelled by boys or men, denominated *putters* or *hurriers*, who deliver them up at certain points, where they meet horses with the returned empty boxes which are again conveyed to the workings in order to be filled. One horse generally drags six carriages chained together, each bearing an empty box; and a small crane is often used for the purpose of raising up the loaded boxes to the carriages, by which they are conveyed to the bottom of the drawing-shaft. Here proper persons, called *bottomers*, *bridgers*, or *hookers-on*, attach the loads to the tackling-chains, which, by the help of a wimsey, horse-gin, or turn-beam, elevate them to the top, to be dragged off to the pit-hill, and stacked, or otherwise disposed of, as circumstances require.

Chap. IV. Means of obviating Accidents.

Various remarks of a practical nature remain to be made, as connected with the subject of working coal. The first we shall offer respect,

Sect. I. *Water from Wastes.*

One source of danger in coalieries is water. This may accumulate in large quantity on the cessation of the steam-engine, or the occurrence of some obstruction in the water-level. But in either way, it is obvious, the workmen must almost necessarily be apprized of their danger, and have time to escape. A much more formidable source of this element, and one which has repeatedly proved fatal, is that of a *waste*, or old working, into which the miners, incautiously and unwittingly have penetrated. In the Tyne and Wear district, it is well known there exists a vast number of wastes, which, from the imperfection of the mode of working adopted by former generations, were generally much shallower than the modern pits. These accordingly constituted, in reality, so many cisterns, into which the water from adjoining springs and feeders naturally poured. Being higher, therefore, than the mines lately opened, it is evident that if by any means a communication was effected, the water would instantaneously gush into the latter, with a force which, in many cases, it would be absolutely impossible either to overcome or escape. One can scarcely conceive a more agonizing situation for human beings to be placed in, than that which there is every reason to believe many unfortunate creatures have experienced from so frightful an inundation. The picture which a writer, in Dr Thomson's Annals of Philosophy, (August 1814,) draws of it, can scarcely be called an exaggeration. Speaking of a recent disaster of the kind at Heaton coaliery, by which no less than 75 men and boys perished, he says,—"Some of these were doubtless immediately drowned by the rapid influx of the water; but others were, in all probability, doomed to one of the most lingering and horrible deaths of which the mind of man is able to form any conception. Entombed alive in the earth, at a depth of 500 or 600 feet; shut out from all communication with those on the surface; driven in their search of refuge from the roaring flood, to seek shelter in some of the more elevated parts of the mine; there, if they succeeded in escaping the torrent for the moment, to lie in darkness and despair, some of them perhaps in solitude, conscious that every hope of being rescued was for ever cut off; waiting the approach of the water to swallow them up, or the equally certain ravages of hunger or suffocation,—no

Accidents.

sound to be heard but the dying groans of their companions. The imagination turns away, with sickening horror and affright, from the picture which itself has drawn; and the only hope which even the most benevolent heart can cherish with any degree of patience or composure, is, that the noxious air or submersion in the water, must have speedily put a period to their miseries by terminating their existence." Against such an awful catastrophe, it is remarked, there neither is, nor probably can be provided any effectual safeguard. But a good deal may be done by way of prevention for the future, and more particularly by the most cautious examination of the site and probable extent of former workings, and by taking care to record, in a proper place, every similar information respecting those mines which are now going on. According to the writer now alluded to, Mr Thomas, of Denton near Newcastle, so far back as 1797, proposed some plan for the establishment of an office for this purpose, but, from some unexplained cause, it was never acted upon. The increasing importance of the subject, however, having awakened attention, that gentleman's paper was again read, (6th June 1815,) before the Literary and Philosophical Society of Newcastle, and by them ordered to be published, together with supplementary observations by Mr William Chapman, civil engineer, which it is hoped will enable the public to profit by the judicious and important remarks suggested. It may be here noticed, as applicable in some degree or other to every case of impending or seeming danger which may occur in a mine, that it is extremely desirable some mode of communicating alarm to the workmen should be adopted. The value of such a contrivance, whether by bells, trumpets, or other instruments, is well illustrated by the writer from whom a quotation has been made. "From the accounts received from the survivors of the late terrible catastrophe at Heaton coaliery, it is evident, that had a more perfect system of alarm as well as of discipline prevailed, a considerable proportion of the unfortunate miners might, nay would, have been saved. Indeed, it is easy to imagine how it may happen, that a workman, or set of workmen, in any particular district of a coaliery, shall have satisfactory evidence of approaching danger, and save themselves, by rushing to the shaft, while they have no means of giving timely warning to others working at the distance of perhaps more than a mile from them. This actually happened at Heaton. The men who were working at the fatal spot where the water burst through, extricated themselves by hastening to the shaft, but before the alarm could be spread to the more distant parts of the mine, where most of the men appear to have been at work, the water had formed an impassable barrier, and deprived them of all chance of retreat."

Sect. II. *Crushes or Sitts.*

Another occurrence of an alarming kind, which has destroyed several mines, consists in the sinking or depression of the upper strata, so as to crush the workings, and perhaps entirely close up the coaliery. This is denominated a *crush* or *sitt*, and generally arises from the smallness of the supporting pillars, which are insufficient for the superincumbent load, or from the softness of the floor giving way to the pressure of the pillars. It rarely takes place without some warnings, and if early perceived may often be prevented by the erection of large pillars of stone among the coal pillars, or the addition of more supports. If the progress, however, which the depression has already made threaten a speedy subsidence, the best practice, where any thing farther than escape is advisable, is to work away the coal pillars in the vicinity of the crush, so as to allow part of the roof to come freely down and settle without affecting the remainder. A complete separation of the roof from the coal to the surface, may prevent the extension of the evil, and of course it is better to lose a part than the whole. Generally, it has been noticed, when a crush proceeds from the rise to the dip of a mine, it is more difficult of arrest than when it goes in the contrary direction.

Sect. III. *Accidental Fire.*

Coal mines are liable to take fire, either from accident, or the spontaneous combustion of some of their own materials, or another cause hereafter to be alluded to. Against the first, the only preservatives are the exercise of care, and a well managed discipline among the workmen. The second is a remarkable, but by no means an uncommon event. In some mines, a thin stratum of greyish coloured earth is found near the top of the coal, which has the singular and highly dangerous quality of taking fire sometime after being exposed to the air. Before this peculiarity was well known, the coaliers were in the habit of throwing the substance among the other rubbish behind the puncheons, and the consequence was frequently the occurrence of fire, for which it was not an easy matter to account. It is now carefully picked up and removed to the surface. The presence of pyrites in small coal appears to have sometimes produced combustion, and hence a notion, perhaps unfounded, has prevailed in certain places, that the small coals themselves are liable to the same operation. However this be, it is obviously prudent to separate, as much as possible, whatever may give rise to so alarming an event, and to keep the passages and chambers unclogged with refuse of any kind. If the fire be soon observed, and only moderate in extent, it may speedily be extinguished by the application of water collected during the occasional stopping of the steam-engine, or damming the water-level. But cases have been known, in which it was found necessary absolutely to drown the works in order to prevent their entire consumption by fire. A very ingenious, and probably, at least in certain cases, a very practicable method of extinguishing fire, was suggested some years ago in the *Journal des Mines*, a periodical work published for sometime at Paris. It consists in the application of carbonic acid gas to the flame. There can be no doubt of the efficacy of the remedy in any instance, but the difficulty lies in the obtaining and preserving the gas in sufficient quantity, and directing it to the scene of action. The ingenuity of modern chemistry and mechanics may not be unprofitably taxed to render the suggestion available.

Sect. IV. *Choak and Fire Damps.*

But the evil of most alarming occurrence in coal mines is that of an atmosphere, either unfit for the purposes of respiration, and the continuance of artificial light, or of so inflammable a nature as to take fire on the application of flame, and explode, to the almost certain destruction of those who are exposed to it. The gases now alluded to as so much to be dreaded, are of two kinds. The first, consisting chiefly of carbonic acid, is heavier than common atmospheric air, and consequently sinks to the bottom of shafts and mines, where, if in sufficient quantity to exceed the height of the men and animals engaged in the work, it proves speedily fatal by suffocation, or by excluding the oxygen gas, which is essential to breathing. This pernicious vapour is variously termed *choak-damp*, *black-damp*, *sweat-damp*, *styth*; and the animals destroyed by it are said to be *damped* or *stifled*. There is some difference in the ability to sustain this gas in different animals. Men are almost instantly killed by it, horses have been known to exist in it for two days after the former have perished, and asses are said to survive horses for nearly the same period.

The other gas is a compound of hydrogen and carbone, very similar to what is obtained from the distillation of coal. This *fire-damp* or *wild-fire*, as it has been called, has the singular property, when mixed with common air, of taking fire on the contact of flame; and so rapid is the communication of the fire, that more than 100 lives have been destroyed by it in a single instant of time. It is specifically lighter than common air, in which particular it differs from the choak-damp, and consequently seeks the upper parts of mines, in some of which, there is reason to believe that, from want of proper circulation, it has been accumulating for many years. It is most abundant in deep mines, and seems chiefly to rise out of chinks or fissures in those strata which are broken by the occurrence or neighbourhood of dykes and troubles. In the opinion of Sir Humphrey Davy, who has so carefully studied the causes, nature, and remedies of this most destructive evil, its prevalence, as a spontaneous product of the strata, is to be explained on the supposition of the coal having been consolidated under great pressure.

Free ventilation is the natural and effectual preventive and cure of these pernicious gases. And hence a number of contrivances has been employed to accomplish it. Some of these have been already mentioned in speaking of sinking and cutting levels. These and some additional modes will be best understood from the consideration of the Figures Plate 51. A description of an ingenious method may be here given as of some utility in certain cases. It is practised by Mr Joseph Butler of Killamarsh-Forge. This gentleman sinks a small shaft at a short distance from his air-shaft, of about three feet diameter, and at two yards below the surface; he makes a thurl of the same size through to the air-shaft, which is commonly $7\frac{1}{2}$ feet diameter. The air-shaft above this thurl is close domed over with brick. The small shaft is now provided with a cylindrical fire-pan, two feet in diameter, and the bottom of the shaft below the thurl acts the part of an ash-pit. This plan is conceived vastly superior, as a means of ventilating, to the use of close fire-places and chimneys so commonly adopted by sinkers, and occasionally employed also as an appendage to permanent air-shafts. In the case of the carburetted hydrogen accumulating, when cutting headings or thurls, so as to endanger the workmen, the same gentleman had recourse to the following process for its removal. A slight tram-road was laid along the bottom of the heading, and a pulley kept fixed in or near the forefield, over which a rope passed, so that when the gas was suspected to have collected during the cessation of work, the men on their return, by means of it, drew the tram, carrying a lighted candle into the further end of the thurl. The gas would immediately explode, but the men had previously retired into ventilated places, out of the direct passage from the thurl to the shaft, taking care always to open the doors, and remove every obstruction from the gates and shafts. Bunches of gorse or furze, disposed like a fan on the tram, are sometimes used to sweep every part of a thurl, and disperse both kinds of damp. See Mr Farey's work, from which the preceding remarks are extracted, and the publications referred to by him.

But highly beneficial as these and other practices may have been found, they must all yield in point of value and importance, as far at least as the fire-damp is concerned, to the invention of the illustrious chemist whose labours in behoof of the miner have already been commended. An account of the steps which conducted to it, and a description of the instrument which associates his name with one of the most enviable services to suffering humanity, naturally claim attention in this place.

The frequent occurrence of fatal explosions in the coal mines in the north of England, statements of which found their way into the newspapers and public journals, excited a degree of horror in the minds of liberal and benevolent men. It seemed the imperious duty of science to consider the causes of such catastrophes, and if possible to provide against them. There were not wanting persons, in a country which boasts of its attainments and its humanity, who felt themselves immediately compelled to undertake a task no less difficult than important. Dr Henry, Dr Clanny, Dr Grey, Dr Trotter, Dr Murray, Messrs Buddle, Stephenson, Ryan, Longmire, Holmes, Children, Menzies, are the names of a few of the gentlemen who, in various ways, speculatively or practically, engaged in it with commendable ardour, and more or less success, from about the beginning of the present century. A satisfactory examination of the nature of the exploding gas was followed by the discovery of the places in the coal mines from which it most abundantly issued. The advantage of a free circulation of air was on all hands admitted, and accordingly the art of ventilation was carried to an extent which seemed to preclude improvement, or at least more perfect application. Thus in the first report of a society established in Sunderland in 1813, for the purpose of preventing accidents in coal mines, Mr Buddle expresses himself decidedly as to the impracticability of any further advancement in the mechanical contrivances for promoting efficient circulation.

"On the strength of my own experience in coalieries thus circumstanced," says that respectable man, Accidents.

I freely hazard my opinion, that any further application of mechanical agency towards preventing explosions in coal mines would be ineffectual; and therefore conclude, that the hopes of this society ever seeing its most desirable object accomplished, must rest upon the event of some method being discovered of producing such a chemical change upon carburetted hydrogen gas, as to render it innoxious as fast as it is discharged, or as it approaches the neighbourhood of lights. In this view of the subject, it is to scientific men only that we must look up for assistance in providing a cheap and effectual remedy." Discouraging as such an opinion from so competent a person was considered, little or no doubt could be entertained of its truth by those who were acquainted with the efforts which had been made, and the ingenuity which had been exercised in the matter.

It will easily be understood, then, that notwithstanding the improvements in ventilation, fatal accidents continued to distress the public feeling, and that in such a degree, that it sometimes became a serious subject for inquiry, whether the working of certain coal mines ought not to be abolished, as little short of foreseen homicide. The conduct and spirit of sundry proprietors, it would be improper to conceal, gave no small countenance to the arguments of those who thought legislative interference justifiable; and at all events afforded the highest cause for censure. Can it be believed, that they not only affected an air of solemn repugnance to give any information, as if they were afraid the "secrets of their prison-houses" should blast the hazardous trade in which they were now so odiously engaged; but that in some cases they refused, virtually if not directly, the introduction of an instrument, which principle as well as experiment had to a certain degree pointed out as calculated to lessen the danger to mens lives? Yet all this is capable of proof, and it would be an act of injustice not to assign one evidence out of several, for adducing so serious a charge.

Dr Clanny's paper read before the Royal Society, December 7. 1815, may suffice in this place. That intelligent physician had for some years been engaged in devising means for the security of the coaliers; and in a paper also read before the Royal Society on May 20. 1813, had proposed a mode of giving a steady light in mines, without the danger of an explosion. This was the employment of a lamp, of rather a cumbersome form, and undoubtedly liable to sundry objections, but nevertheless capable in many cases of accomplishing the desirable object in view. It deserved the countenance therefore of every one who regarded the value of human life beyond a mere *item* in the expence of carrying on a coaliery, and who possessed no more effectual means of securing it from so dreadful a termination. Between the date of his first communication, however, and about two months of his second, it does not appear that any use of his invention had been so much as attempted. On the contrary, he asserts, that he "made many fruitlesss efforts to descend a mine charged with inflammable gas;" that, "at one time the person who invited him to his house, at a considerable distance from Sunderland, went from home when he arrived;" that "two years afterwards when he arrived at a person's house who had promised to descend a coaliery with him, he was told that he had just examined all the parts of the mine, and that there was no inflammable air to be found in any part of it," (a statement which Dr C. afterwards discovered to be untrue); and that, in fine, "the ungenerous opposition he met with, is almost incredible!"

According to this gentleman, the number of explosions which had taken place in his district, between the periods above mentioned, was considerably greater than had occurred in an equal time before his first communication. It is proper to enumerate these shocking events, as illustrative of the magnitude of the evil for which a remedy was so earnestly sought. An explosion took place in the Hall pit at Fatfield, September 28. 1813, by which 32 persons were killed, and four wounded; one at Felling on December 24. same year, killed 23, and severely wounded 21; the Hebburn coaliery exploded on Aug. 12. 1814, by which 11 men lost their lives, leaving nine widows and 27 children, in the greatest distress; an explosion at Seafield coaliery on Sept. 9. 1814, killed four men; the Success pit exploded June 2. 1815, when no less than 54 persons were killed on the spot, two were suffocated, and 15 were so severely wounded, that some of them afterwards died; the Sheriff-hill pit exploded July 27. 1815, by which 10 men and boys were killed. The explosion at Felling coaliery, above mentioned, it may be remarked, occurred 19 months after a similar but more distressing event, by which 92 persons perished, and in the interim the greatest pains had been taken by the humane proprietors to secure perfect ventilation and good management.

An experiment was at length made of the efficacy of Dr Clanny's lamp on Nov. 20. 1815, at the Herrington-mill pit, and with decided success. But the scale was small, a single lamp only having been employed, and cautious persons anxious for its success undertaking its management. The principle of the lamp, on which its safety-giving power depended, was the separation of the external and the internal carburetted hydrogen, by means of water. This instrument however was liable to be upset, and to be consequently deprived of the water which formed its security valve. It was, moreover, far from being very portable; and, accordingly, in its original state, could scarcely well be carried about for exploring and working mines. The inventor remedied some of its imperfections, and accommodated it more readily to use. But, in the meanwhile, several other persons were engaged in the subject, and on the whole with more appropriate success.

Thus Mr Ryan made a lamp, differing in sundry respects from Dr Clanny's, (though avowedly the hint was furnished by that gentleman's contrivance,) by which the water was prevented from spilling, and some other beneficial purposes were accomplished. Messrs Brandling and Murray, too, constructed lamps, apparently on the principle of not allowing the exploding gas in any way to come into contact with the flame, and this they proposed to accomplish by means of flexible tubes. But these devices, however commendable, were surpassed in simplicity and adaptation to common use by the safety lamp of Mr Stephenson, which was tried with success in Killingworth coaliery on the 21st October 1815. It afterwards underwent some improvements, and in its amended state was introduced into common use at that place. There is reason to believe that this gentleman was led to his invention rather empirically than as a deduction from science. But this ought not to detract from his merits; and again it is thought only justice to declare, that as, in point of principle, Mr Stephenson's lamp seems decidedly similar to Sir Humphrey's, so the former gentleman is entitled to the honours of priority of invention. This decision, it may be remarked, is the result of no small labour bestowed on the impartial perusal of a variety of essays, treatises, &c. &c. which enter on the respective claims of these two persons.

Before proceeding to the particulars of Davy's services in this important subject, it may be proper to mention the proposal by Dr Murray of Edinburgh, of a mode of preventing explosions, as read to the Royal Society of that city in the winter of 1815. The idea on which this was founded may be thus explained: As the inflammable gas, which constitutes the fire-damp, collects in the upper parts of the passages and workings of mines, where it mixes with atmospheric air, and at last forms a compound which explodes on contact with the lights used by the miners; and as this dangerous mixture can seldom or never be effected in such a quantity as to fill the whole space, at least during the time that the mine is working, for before this period the workmen would become sensible of its existence by its effect on their respiration, so the simple mode of obtaining security against its exploding, is to bring the air which is necessary for sustaining the light of a lamp or a candle, from the lower part of the mine. This may be easily done by burning the lamp within a glass case, perforated with a hole at top to allow the escape of the heated air and smoke, which would prevent the entrance of the external air, and having attached to its bottom a tube reaching to the floor of the mine, in order to convey the necessary supply of air for the flame. In the lamps intended for moving about, this tube might be made of leather; in the fixed lamps, it would be better to construct it of a metallic substance; and in order to guard against external injury, a wire-netting was to cover the glass case. This proposal was made known to sundry persons at Newcastle, and received the attention and applause which its ingenuity deserved. But the greater simplicity of the mode now to be described superseded its adoption.

Influenced by the general feeling which thus existed, and the hope of contributing some aid to the cause of humanity and science, Sir Humphrey Davy repaired to the north of England, where the horrible explosions of coal mines had recently occurred with most distressing frequency. He immediately visited the mines near Newcastle, and commenced a series of observations and experiments, which had for their object .complete exposure of all the circumstances of the case. In these he was encouraged and assisted by the proprietors, inspectors, &c. in a manner gratifying to himself, and highly honourable to their characters. It soon appeared to him that the degree of light which was requisite for working the mines was greater than could be afforded by any other means than the combustion of some inflammable body, and hence the idea of employing electricity or phosphorus was instantly abandoned. His next step was to discover whether the fire-damp itself had any qualities, in which a remedy might be found for its destructive agency. In the course of the necessary trials now made, he ascertained the accuracy of the common opinion, that this gas is essentially the same with the inflammable gas of marshes, and that it consisted of hydrogen and carbone in certain proportions. His next inquiry determined that the presence of some quantity of atmospheric air was essential to its combustion. A mixture in equal parts burnt on the approach of flame, but did not explode. Successive additions of atmospheric air were ascertained to aid its tendency to explode, and the combination which appeared to have most power was that of from seven to eight parts of the former to one of the inflammable gas. To these experiments succeeded the investigation of the degree of heat required for the explosion of the mixture. The result was, that the fire-damp differed from other inflammable gases in requiring the high temperature furnished by a substance in the state of combustion for its explosion. Thus it did not explode, for example, when subjected to a common electrical spark, whereas strong sparks from a Leyden jar had the same effect on it as the flame of a candle. Even charcoal blown up to whiteness failed in exploding it, as did also an iron rod at the common degree of white heat. But when brought into the state of combustion, this last was able to cause explosion. Having satisfied himself of these particulars, Sir H. D. proceeded to ascertain the degree of expansion of these formidable mixtures during their explosion, and also what power they had to communicate flame through certain openings to other explosive mixtures. The former was found much less than had been imagined, considerably less indeed than that of any other elastic fluid when brought into a similar state. The latter particular presented some highly interesting facts which conducted in reality to the means of safety afterwards devised.

In the first place, the narrowness of the openings through which the communication was attempted to be made, was observed to afford a material obstacle to the conveyance of the flame. Thus, a mixture of the gases which was highly susceptible of explosion, could not be made to undergo that change in a glass tube 1-7th of an inch in diameter. Again, the flame of the same mixture, when exploded in a jar which communicated with another mixture of the gas contained in a bladder, through an aperture 1-6th of an inch in diameter, and with the atmosphere through an aperture of $\frac{1}{2}$ an inch diameter, passed into the latter, but had no influence on the former. This obviously implied the possibility of preventing the extension of the flame produced by the explosion of the gas, without entirely cutting off all communication with another portion of the same mixture, and was with much propriety, apparently, ascribed by Sir H. D. to the loss of heat on the cooling surface forming the communication, so that in reality the degree of

Accidents. temperature required for the explosion of the gas was not applied to the separate portion. Some confirmation of this inference was afforded by the observed fact of tubes consisting of metal, which is a better conductor of heat than glass, having still more power of resisting the transmission of flame during the explosion. The very high temperature, therefore, which this inflammable material required for its exploding, presented that very quality in its nature of which he was in search, as it evinced the possibility of confining its flame in such a manner that another portion of the very same gas immediately in its vicinity, and in reality in contact with it, should not undergo any change by its explosion. Here it may be remarked, the previous contrivance of Mr Stephenson, by no means deduced from scientific reasoning, and probably quite unknown to Sir H. D., received its explanation as a means of preventing this dreadful effect. That gentleman had actually found that a metallic covering to a glass lamp, when perforated with holes of a small diameter, not only suffered a due degree of light to be emitted, but also obstructed the transmission of flame to the surrounding atmosphere. The conditions of the problem to be solved were now considerably lessened; and in reality, we may add, had Sir H. D. known of Mr S.'s instrument, he could have been at no loss to discover in it the object of his own labours virtually accomplished. All that remained for him now to do was the application of a covering to a lamp, of such a kind that it should admit the requisite light to escape from within, and at the same time prevent its ever being accompanied with flame, from which alone, it may be said, his experiments proved that any danger was to be apprehended. To his inventive genius this preservative envelope did not long remain a *desideratum*. He speedily discovered that a wire gauze would answer the desired end, provided its interstices or meshes did not exceed a certain dimension. It is unnecessary to detail the experiments which conducted to his practical results, or to specify the modifications which his safety-lamp underwent to obviate all objections and accomplish this security so much desired. Suffice it now to refer to the figure and explanation for a view of it in its improved condition, and to state the confidence which, after sundry alterations and controversies, has been at last almost universally expressed in its employment. Besides its almost general adoption in England, whereever danger was to be apprehended, this important instrument has been introduced on the continent with equal gratitude and benefit. Thus, in the province of Hainault, in Flanders, one of the richest coal districts in Europe, and where no fewer than 100,000 persons are employed in the mines, it is said that no explosion has happened since the time of its being brought into use. Of late, it may be mentioned, an addition has been made to the safety lamp by Mr Newman, which promotes its utility. This consists in the application of a convex lens to the lower part of the wire-gauze, the effect of which is to direct a strong light on any part of the mine where it may be needed, whilst it preserves a portion of the gauze itself from the small coal and dust, which are so liable to obstruct it.

Plates.

Explanation of the Plates.

Plate 50.—Fig. 1. A B represents the surface of the ground; C D are two seams or beds of coal, which are dislocated or thrown out of their course by the dyke E, and again restored to it by the dyke F. The dyke G produces a change in the direction of the strata, but no elevation or depression; and at H a slip or separation appears, without the intervention of any foreign body. The dyke I represents that case in coal strata, in which neither elevation, depression, nor change of course is produced. The strata of coal will be seen in the cliff or ravine at K and L.

Fig. 2. is a section of the singular coal strata at Quarrelton in Renfrewshire. A A A is the surface, which in many places exhibits the whinstone rock C C C; B is a small patch of gravel and sand; D D D is the stratum of sandstone, and the stratum immediately above the coal; E E E the coal itself; F G and H I are two slips or dislocations of the strata, the first 30 and the other 50 feet. K K are pits or shafts sunk to the coal.

Fig. 3. is another section of the same coal-field; A A A is the surface; B is the patch of gravel; C C is the whinstone covering the coal strata; D D D the sandstone lying above the coal; E the coal stratum, where it seems to be overlapped, producing a thickness of not less than 60 or 70 feet of coal. Something of the same kind appears at F and G; but the strata have not come into contact; they are separated by a body of sandstone at M. In sinking the shaft K, the object was to find the coal at M; but in passing through the sandstone, a very unexpected but fortunate discovery of a large mass of coal was made at N. H I is the same hitch or slip of 30 feet as F G in the former section, and L is the same shaft as K on the left side of the section of Fig. 2.

Fig. 4. exhibits a section of the manner in which the operations are conducted in the coal-field A A; B and C are two seams of coal, which have been ascertained, by boring or otherwise, to exist in the field. The shaft D is sunk to the first seam of coal B, which is drained of water by the day-level E, and when it is necessary to carry the workings to the next seam C, the shaft F is sunk to the lower seam C, and an engine is erected upon it to draw the water from the lower workings, and to discharge it into the level E. As the stratum of coal, which dips from the engine-pit, cannot be freed from water without additional machinery, a drift or level, carried from the point B to G in the engine-pit, will relieve all that part of the coal to the dip of the engine-pit, as far as the level is carried; and if the engine has sufficient power, a similar level, carried from C to H, will free that part of the lower seam between the engine-pit and the point C. The dyke I throws down the strata to such an extent, that the upper seam B comes in contact with the lower seam C, and, by perforating the dyke I, may be cleared of water, and the coals may be drawn up by the shaft K; and if the shaft K be sunk to the lower seam, that seam may be cleared of water by driving a level through the dyke I to the engine-pit. If the engine have sufficient power, that

Plates.

part of the field in which the strata are thrown up by the dyke M, may be relieved from water by perforating the dike at N and O, and sinking a pit from the two seams to form the communication, and the coals may be drawn up by the shaft P.

Plate 51. Fig. 1. 2. and 3. is a representation of the lamp contrived by Mr George Stephenson, of Killingworth coaliery.

Fig. 1. A, B, C, D, the lamp; A, E, F, D, the cover for the top; G, the tube for supplying the oil; H, the wire to trim the wick; I, the perforated plate covering the air-chamber which surrounds the oil vessel; K, L, apertures through which the air passes into the air-chamber; M, tube for the wick. Fig. 2. N, O, P, Q, the cover to protect the glass cylinder. Fig. 3. A, B, C, D, a, section of the lamp; a, b, c, d, the capillary tubes; E, F, the apertures answering to the round holes in Fig. 1.

Fig. 4. represents Sir Humphry Davy's wire gauze safe-lamp: A, the cistern which contains the oil; B, the rim in which the wire gauze cover is fixed, and which is fastened to the cistern by a moveable screw; C, an aperture for supplying oil, fitted with a screw or a cork, and which communicates with the bottom of the cistern by a tube; D, the receptacle for the wick; E, a wire for raising, lowering, or trimming it, and which passes through a safe tube; F, the wire gauze cylinder which should not have less than 625 apertures to the square inch; G, the second top, ¾ of an inch above the first; H, a copper plate which may be in contact with the second top; I, I, I, I, thick wires surrounding the cage to preserve it from being bent; K, K, are rings to hold or hang it by.

Fig. 5. is a representation of the operations for working and ventilating a coal mine. A is the engine-pit; B the pit by which the coals are drawn up; A, a, B, the mine between them; B C is the first working or winning head-way; b. b. b. the rooms which pass off at right angles, and in this mode of working were twelve feet wide; c. c. c. the workings called throughers or thurlings, nine feet wide, which are also carried at right angles from one room to another; d. d. d. are the pillars of coal left at the first working for supporting the roof; D D are two large masses of coal left near the bottom of the pit to secure it from the danger of the roof falling in; f. f. are large pillars of coal, which are left next the level to secure it from the falling in of the roof; g. g. is a dyke which depresses the coal on the opposite side; and h h are large pillars and masses of coal, which are left unwrought adjoining to the dyke where the roof happens to be tender. In carrying on the workings according to this plan, the rooms to the right of the winning head-way are opposite to the pillars on the left, by which the roof of the main-road b. c. is more effectually supported, and when the workings are regularly conducted each pillar is opposite to the thurlings. As in this case the coal on the other side of the dyke is depressed to relieve it from water, a level is driven from the engine-level through the dike, until it intercept the coal at i. and from this a new level mine is driven in the coal at i. i. and a new winning headway i. k. For the purpose of ventilating the new workings, a small mine is driven from the room h, and a communication is made.

For ventilating a mine of this description, the passage, a. is closed up by a deal partition, or a brick or stone wall, and this kind of building is called a *stopping*. These stoppings and their effects will be seen by consulting the plan, and observing the course of the current of air indicated by the position of the arrows.

Cobalt || Coblentz.

COAT OF ARMS, a habit worn by the ancient knights over their arms, both in war and tournaments, having short sleeves, and open at the sides, and reaching as far as the middle of the body. This habit, which is still borne by heralds at arms, was sometimes furred with ermine and hair, upon which were applied the armories of the knights, embroidered in gold and silver. See HERALDRY.

COBALT, a metallic substance, formerly arranged among the semi-metals. For its properties, see CHEMISTRY; and for an account of its ores, see *Mineralogy* under GEOLOGY.

COBITIS, THE LOACHE, a genus of fishes belonging to the order of Abdominales. See ICHTHYOLOGY.

COBLENTZ, a town of the electorate of Treves in Germany, contains about 10,000 inhabitants, whose commercial pursuits are limited to the productions of the country, and whose manufactures extend only to japanned tin wares, is adorned with several handsome churches and a college, a fine bridge of ten arches over the Moselle, which washes one side of the town, as the Rhine flows along another side, and is surrounded with mountains clothed with vineyards.

Cobourg || Coccus.

COBOURG, a town of Saxony, stands on a small river in a valley, enclosed by mountains, is a fortified place, enjoys the advantage of a college for the education of youth, and the ducal palace contains a cabinet of natural history, and medals, and a fine collection of prints. The petrified wood found in the alluvial soil in the vicinity furnishes employment to many of the inhabitants in cutting and polishing it.

COCCINELLA, a genus of insects belonging to the Coleoptera order. See ENTOMOLOGY.

COCCOLOBA, a genus of plants belonging to the Octandria class; and of which *uvifera*, or sea-side grape, is common on the shores of Jamaica.

COCCUS, a genus of insects belonging to the order Hemiptera. See ENTOMOLOGY.

COCULUS INDICUS, supposed to be the fruit of *menispermum coculus*, is a berry which is sometimes mixed with malt-liquors for the purpose of communicating an intoxicating quality, and, formed into a paste, is employed by fishermen as a bait for fish. The use of this berry in malt liquors is strictly prohi-

COALIERY.

Fig. 1.

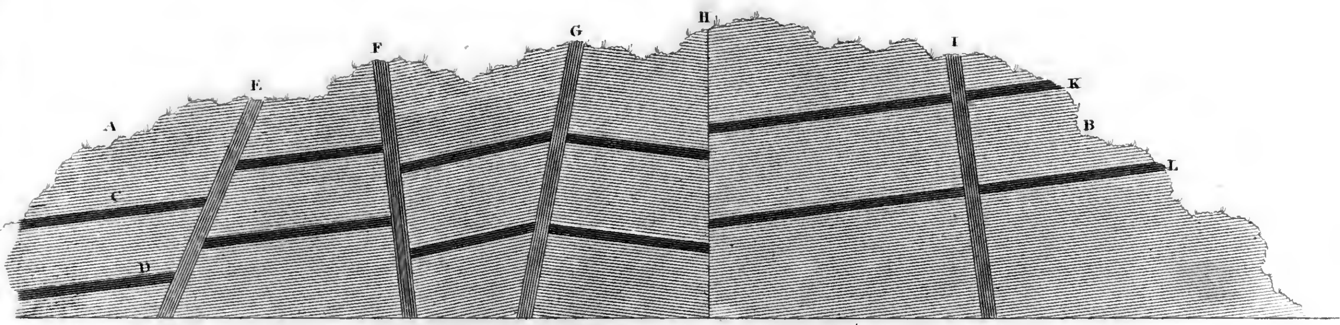


Fig. 2.

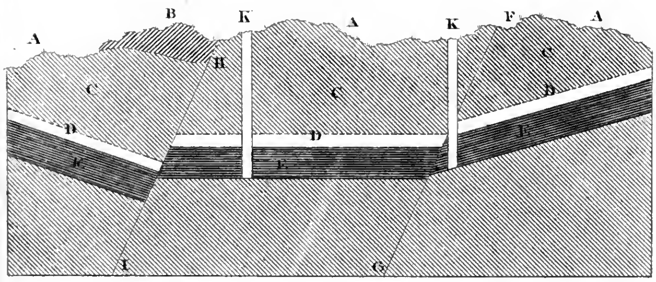


Fig. 3.

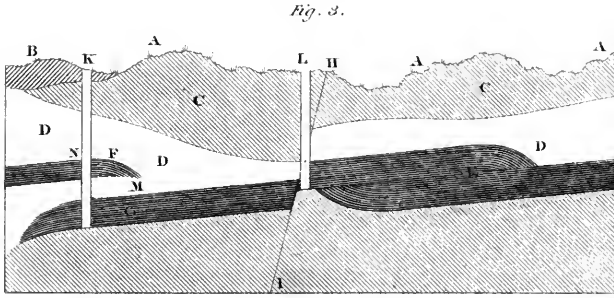
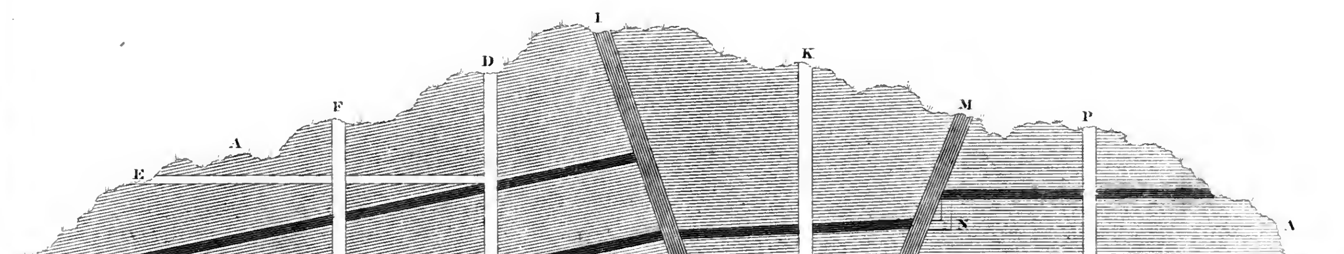


Fig. 4.



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COALIERY.

Safety Lamps.

Fig. 1.

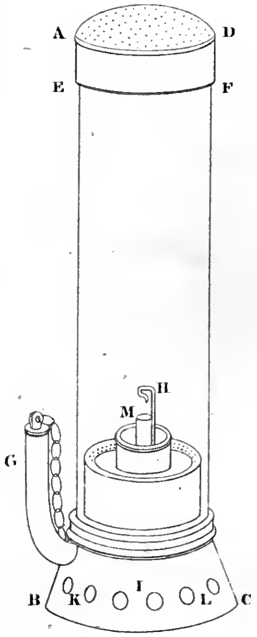


Fig. 2.

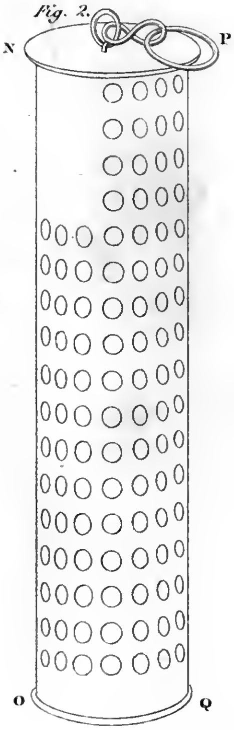


Fig 3.

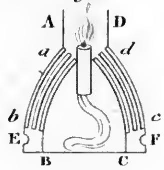


Fig. 4.

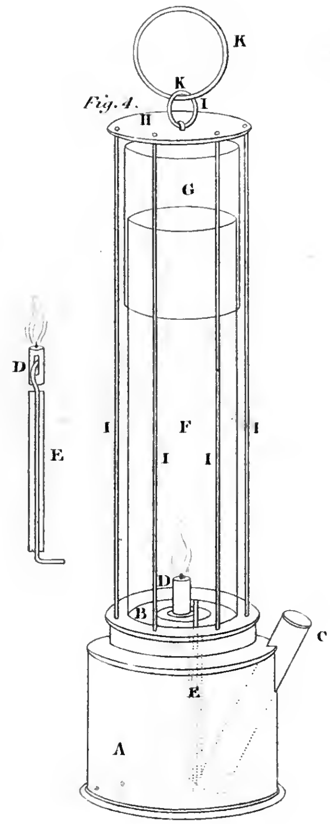
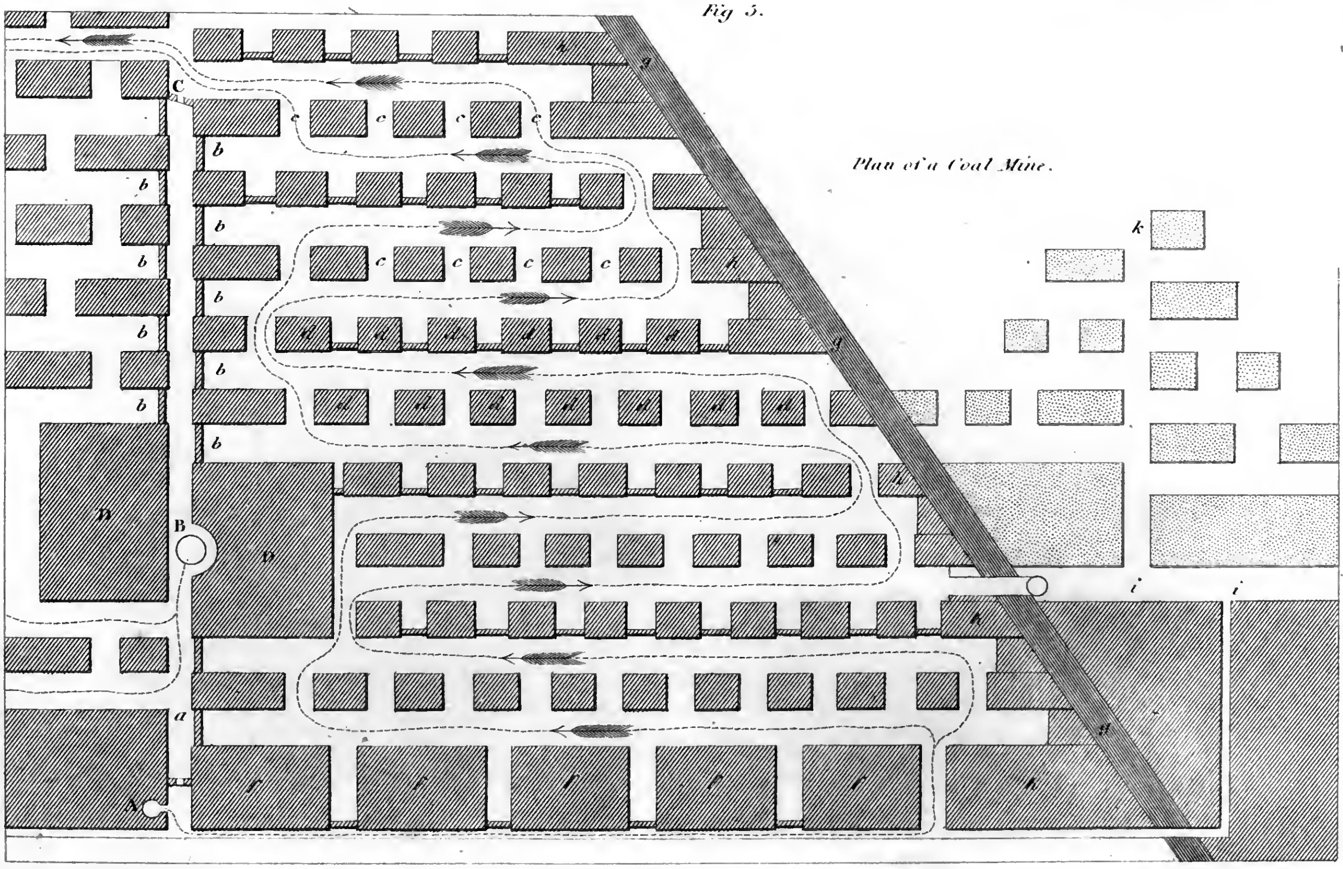


Fig 5.



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bited by an act of the British legislature, which is sanctioned by severe penalties.

COCHIN, a province on the west coast of Malabar in India, is intersected by the 10th degree of north latitude, and is bounded by Travancore on the south, the sea on the west, the province of Malabar on the north, and the Dindigul district on the east. In the northern parts of the province, the rice grounds in the vallies, favourably situated for irrigation, afford two crops annually; in some places valuable forest trees exhibit a luxuriant growth, and in others of greater elevation excellent pastures abound. Many villages, which are observed to be in general well built and cleanly, are inhabited by Nazarenes or Christians of St Thomas; and Jews of the white and black class are numerous throughout the province.

The Cochin rajah maintained his independence later than most of the Hindoo chiefs; he was at last compelled to pay tribute to Tippoo, and in 1791 he transferred his allegiance to the East India Company. A new treaty was entered into in 1809, and the province may now be considered as part of the Company's territory. The subsidy was then increased; all Europeans, not approved by the British Government are excluded from the country, and from the service of the Rajah; the British troops are to have free access to towns and forts; and the management of his external political relations is transferred to the British.

COCHIN, the capital of the province of the same name, on the coast of Malabar, is about 170 miles north-west from Cape Comorin, was built by the Portuguese about the beginning of the 15th century, was afterwards strongly fortified, and is more than a mile in circuit; was taken by the Dutch in 1663, and having become the residence of Jew, Hindoo, and Mahometan merchants, rose to great commercial importance, had a very extensive intercourse with Arabia, and still enjoys a considerable trade, not only with Surat, Bombay, and the coasts of Malabar and Canara, but also with the eastern islands and China. The exports are sandal-wood, pepper, cocoanuts, and teak-wood, and the principal imports are fruits, drugs, spices, silk and cotton stuffs. It fell into the hands of the British in 1795.

COCHIN-CHINA, a kingdom situated in the eastern peninsula of India, stretches along the coast of the Chinese sea, between the 9th and the 18th parallels of north latitude, and the 106th and 109th of east longitude, and is bounded on the south by the Indian ocean, and on the north by the kingdom of Tongquin, on the east by the Chinese sea, and on the west by a range of high mountains, which separates it from the kingdoms of Cambodia and Laos.

Appearance and soil.—The coast of this country is fringed by an almost uninterrupted range of small islands; and the shore is indented by a great number of safe and spacious harbours, as well as by the mouths of many streams, which, as they rise at no great distance from the sea, seldom attain to the magnitude of rivers. As the country, in its whole extent, forms the declivity of the Kemois mountains which stretch along its western frontier in a southerly direction, quite to the shore of the Indian ocean, it exhibits great diversity of surface, gradually rising, like an amphitheatre, from the sea to the summit of the range. Between the lateral hills which branch off from these mountains are many vallies, and even extensive plains of a rich and fertile soil, clothed with all the beauty and variety of tropical vegetation, but in which nature is in general left to her own spontaneous operations, unaided by the power of a skilful cultivation.

Climate.—The latitude of this region sufficiently indicates the high temperature to which it is exposed; but the violent heat of the sun is tempered by refreshing breezes from the sea, and is diminished, in many places, by the elevation of the surface. The spring, during the months of March, April, and May, is said to be delicious; the tropical rains fall in September, October, and November, when the low country is inundated once a fortnight for two or three days at a time, by which the soil is fertilized; and in December, January, and February, cold north winds prevail, occasionally accompanied by rain.

Productions.—The inundations to which the plains of this country are exposed, greatly contribute to their fertility, and fit them peculiarly for the production of rice and sugar-canes. Of the former, two crops are raised in the course of the year, the first in April and the second in October; and of the latter great quantities are cultivated for exportation. Tobacco, cinnamon, silk, cotton, indigo, yams, and sweet potatoes, are abundant in the vallies. Fruits, such as oranges, limes, bananas, figs, pine-apples, and a great variety of other kinds, are common throughout the country. The mountains abound with extensive forests of the most excellent timber among which are found abundance of pine, oak, and teak trees, as also the sandal-wood, the rose-wood, the aquila or eagle-wood, and the lignum aloes, which in China and Japan fetches sometimes 200 ducats a-pound, and is formed into bedsteads for the emperor, and the rich and great. Gold-dust and precious stones (among which are diamonds) are gathered in the channels of the rivers, of which, as well as of other metals and valuable minerals, vast quantities may be treasured up in the deep recesses of the mountains.

Animals.—The upper regions and forests of the country are inhabited by the elephant, the rhinoceros, the tyger, the boar, the deer, and the antelope, with other beasts of the chase, an amusement with which the sovereign is said to entertain foreign ambassadors, when *the feast of elephants* is celebrated. Flocks of sheep, and herds of short-horned cattle, buffaloes, hogs, goats, ducks and poultry, are reared by the Cochin-Chinese for the purpose of food. The coast and bays of the sea, and most of the rivers, teem with fish of many different kinds, which are caught by nets, baskets, jars, hooks, and lines. The sea-slug, denominated in commerce the trepan, is gathered in the islands which line the coast, as well as the nests of the sea-swallow, to be exported to China. Pelicans of the wilderness, and other aquatic birds, frequent the coast, and come in with the people for their share of the fish.

Inhabitants.—The population of Cochin-China has not been ascertained by any of our European travellers; but some idea of it may be formed from that of the army, which in 1806 was 109,000 men. The Cochin-Chinese occupy a lower degree in the scale of civilization than their Chinese neighbours; but the similarity of their stature, complexion, and features, together with the sameness of many of their domestic manners, superstitions, rites, and prevailing customs, indicate a common origin. The harsh features, and dark complexion of this people, are rendered doubly disgusting by the universal practice of chewing *areca nut* with *betel leaf*, and of smoking tobacco, by which their lips are reddened, and their teeth blackened. A silken bag suspended from the girdle, containing these ingredients in separate divisions, forms a necessary part of the dress of all ranks, and of both sexes. Every man who can afford it is attended by a servant, whose office it is to carry his master's smoking apparatus. The dress of the sexes is nearly of the same form. Linen is unknown among them, in place of which they wear next the skin vests and trowsers of silk or cotton; over which they have long loose robes with wide sleeves, and collars round the neck, and folding over the breast. People of rank, especially ladies, wear several of such robes over each other, of different colours, which are displayed by causing the undermost to descend lowest, and by curtailing the length of each of those worn above it, the uppermost being the shortest. Their black hair is suffered to hang at its full length, or is twisted into a knot and fixed on the crown of the head; short hair is deemed a mark of abject subjection to a foreign power. Turbans are sometimes worn by the men, and hats frequently by the women, but never caps. All ranks go without shoes or stockings; a few ladies only of the highest rank using a kind of sandals.

The houses of this people are of a very rude construction, being formed chiefly of mud walls, and covered with rushes, or straw of rice. Many houses are also constructed almost entirely of bamboo or wood; and when situated within the reach of the inundations, they are raised on pillars of stone or timber like those of the Birman empire and other places of the Peninsula. Such were the houses of the town of Turon, built on the banks of a river which falls into the harbour of that name, when visited by Sir George Staunton and Mr Barrow, who also inform us, that the ground behind the town was laid out in gardens, and groves of orange, lime, plantain, and areca nut trees; and that the banks on the opposite side of the river were cultivated with rice, tobacco, and sugar canes. They have little furniture, and few domestic utensils; a few mats, pots, bowls, and chop-sticks, with porcelain spoons, comprising the whole. Rice here, as in China, is the staple article of their food, without which they never make a meal; it is eaten along with a relish of spices, pungent vegetables, oil, or animal food, in which the flesh of dogs, and frogs is included. An entertainment, which Sir George Staunton has described, consisted of "three rows of bowls piled above each other, filled with pork and beef cut into small square morsels, and dressed with a variety of savoury sauces; other bowls contained stewed fish, fowls, and ducks, and many had fruits and sweet-meats. Before each person were placed boiled rice to serve as bread, and two porcupine quills, by way of knife and fork. The spoons were made of porcelain, somewhat in the form of small shovels. After dinner, an ardent spirit made from rice was served in small cups around. The host, by way of showing a good example, filled his cup to the brim, in the true European style of joviality, and after drinking, turned up his cup to shew that he had emptied it to the bottom." Vines are said to grow spontaneously on the mountains, but wine is unknown. After dinner the British party were entertained with a comedy, in which "the mirth seemed to be excited chiefly by the peevishness of a passionate old man, and the humours of a clown, who appeared to have no small degree of merit in his way. The place was surrounded with crowds of people, and many of them perched upon the boughs of adjoining trees, from whence they might see at an open part of the building the spectators within doors, about whom they were in this instance more curious than about the actors on the stage." The music by which those theatrical exhibitions are accompanied, is thus described by Barrow. "The horrible crash of the gongs, kettle-drums, rattles, trumpets, and squalling flutes, were so stunning and oppressive, that nothing but the novelty of the scene could possibly have detained us for a moment. Their airs, rude and unpolished as they were, appeared to be regular compositions, and were sung in exactly measured time. One in particular attracted our attention, whose slow melancholy movement breathed that kind of plaintive softness so peculiar to the native airs of the Scotch, to which indeed it bore a very close resemblance. The voices of the women were shrill and warbling, but some of their cadences were not without melody. By different gestures of the head, body, and arm, the dancers assumed a variety of figures, and all their motions were exactly adapted to the measures of the music."

After the play, the party were entertained with feats of Cochin-Chinese agility. Seven or eight young men standing in a circle, were engaged in a game of shuttle-cock. They had no battledores, nor did they employ the hand or arm in any way in striking it. But after taking a short race and spring from the floor, they met the descending shuttle-cock with the sole of the foot, and drove it up again with force high into the air It was thus kept up a considerable time, the players seldom missing their stroke, or failing to give it the direction they intended.

Condition of the women.— As in most other Asiatic countries, females are held in a state of abject degradation; men of the lowest rank regarding them as destined for their use, and the highest as subservient to their pleasures. Hence they are doomed to all those occupations which require bodily exertion and persevering industry, and to that species of submission to the lords of the creation which implies no will of their own. All the laborious exercises in the house and the field belong to them; they are seen drawing the plough, and using the spade and the hoe, and standing from morning to night up to the knees in water, transplanting rice plants. They ply the boats on the rivers and harbours; they assist in building and repairing houses; they carry goods to the market, and cultivate and manufacture cotton for the use of their families. The men in Cochin-China use this proverb, *A woman has nine lives, and bears a great deal of killing*, which sufficiently marks the estimation in which they hold the fair sex. Yet it is said the Cochin-Chinese females are exempt from the confinement and cramped feet to which those of China are subject; that they are frank and lively in their manners, and in their intercourse with strangers; their husbands betray no symptoms of jealousy, and wives and daughters are transferred to others on exceedingly easy terms. But these remarks apply exclusively to the lower orders, for the higher classes confine their wives and concubines, and exercise over them, and their other dependents, the most domineering authority.

Arts and manufactures.—This people do not seem to have any knowledge of painting or sculpture; but (as we have seen,) they have made some proficiency in music and mimickry. In the arts of agriculture and architecture they are far inferior to the Chinese. They work in metals with tolerable skill and neatness; their cast-iron vessels are numerous, and of good shape and quality; they manufacture the porcelain bowls and cups used in their houses, as also the cotton and silk with which they are clothed; but the shed in which Lord Macartney was received was observed to be hung with Manchester calico, printed in a variety of patterns, and the red cloth undervests of the soldiers seemed also to have come from England. In purifying sugar, after the gross syrup has been drained from it, and it has become already granulated and solid, they sometimes place it in layers of about one inch in thickness, and ten in diameter, under a stratum of equal thickness of the herbaceous trunk of the plantain tree; the watery juices exuding from which, and filtering through the sugar, carry down with them all the impurities, and leave the sugar crystallized and white. It is then very light, and almost as porous as a honeycomb, and when dissolved deposits no sediment.

The Cochin-Chinese have carried boat-building to greater perfection than any of the other arts practised by them. They have boats made of wicker work, smeared all over with a paste made with quick lime, from sea shells. But those commonly in use among them are formed of five planks joined together, without ribs or timbers of any kind, being bent to the proper shape by exposure to a flame of fire, fastened together by wooden pins, and stitched with bamboo fibres, after which the seams are smeared. Their vessels of burden are divided into distinct compartments, after the manner of Chinese junks, by which they can accommodate several merchants, and are rendered less dangerous in the event of their springing a leak. The owners have eyes painted on the heads of their vessels, as if to denote the vigilance requisite in the management of them. They are remarkable for standing the sudden shock of violent waves, as well as for being stiff upon the water, and sailing expeditiously.

Commerce.—The situation and resources of this region adapt it peculiarly for being a mercantile country; for its sweet-scented woods, its spices, silk, cotton, and cinnamon, its gum-lac, indigo and ivory, gold, silver, and copper, edible nests, musk, and drugs, are in great demand in most places of the world; and its extensive sea coast and numerous harbours would afford every facility to an unlimited intercourse with foreigners. But its inhabitants are still too rude, and too much exposed to the caprices of arbitrary power, to be able to avail themselves to any extent of these advantages. The inland trade of the country is confined to a limited traffic by way of barter; the inhabitants of the upland regions bringing down their metals, gold dust, precious stones, teak timber, eagle, and other woods, with the other produce of their mountains, and exchanging them for rice and other necessaries of life, cloth, porcelain, and iron utensils, with the inhabitants of the plains. The principal exports are silk, sugar, gold-dust, timber, scented woods, sea slugs, and birds nests, which are carried chiefly to the Chinese and Japanese market, and which are exchanged for saltpetre, sulphur, lead, cloth, manufactures in iron and steel, naval-stores, and opium. The only circulating medium, either among the natives or with foreigners, is a small copper coin, of a round form, with a hole in its centre, and Japanese money, which is paid and received by weight. A great part of the foreign trade of Cochin-China is in the hands of the Portuguese of Macao, who buy up the refuse goods of the Canton market, which they turn to great advantage.

Mr Barrow suggests the propriety of the British establishing a factory on the fine harbour of Torun, one of the largest and safest known. It is deeply scolloped, or indented, so as to afford shelter in some of its inlets in the severest weather; the bottom is mud, and the anchorage safe throughout; it is fanned alternately by the sea and the land-breeze; and a small island, surrounded with deep water, admits of ships lying close to it, in order to be heaved down and repaired. He is also of opinion that the natives would not be averse to have a free intercourse with the British.

Religion, &c.—This people, like most of their neighbours, are worshippers of Budh, the Fo of China. The religious houses of the country are, in general, humble buildings; but there are many extensive and well-endowed monasteries. The rites and mysteries of their religion differ little from what is practised and believed by the Chinese. The Cochin-Chinese offer to the image of their protecting deity the first fruits of the earth, and the firstlings of their flocks; when an infant dies, they offer oil, rice, tea, money, &c. to appease and propitiate the offended deity. Their spoken language is peculiar to themselves; but the Chinese written character is in use among the learned. They derive their moral maxims from the precepts of Confucius, which, however, they practise with great laxity.

Government and army.—The fundamental principles of government are the same as those of the Chinese, and it may be inferred that they have the same laws and the same modes of punishment. In 1800 the military force consisted of 42,000 infantry, with matchlocks; 29,000 cavalry and artillery; 12,000 trained in European tactics; and 26,000 marine forces, occupying different departments. A handkerchief tied round the head, a loose frock, and a pair of drawers, constitute the dress of a soldier. Travellers have imparted no information respecting the revenues of the crown; but it is probable they arise chiefly from a tax on the produce of land levied in kind as in China. And indeed in marriage and funeral ceremonies, in religious superstitions and moral condition, the resemblance between the Chinese and the Cochin-Chinese is so striking, as to afford internal evidence of their having both sprung from a common origin, which is confirmed by historical records. According to these records, this country was colonized by Hoang-te the emperor of China, about 200 years before the Christian era; and, after many revolutions, became an independent kingdom.

COCHINEAL, a beautiful scarlet dye, extracted from an insect of the order of Hemiptera, and called *coccus cacti*, because it is reared on the *cactus opuntia* or prickly pear, which is denominated by the Indians *nopal*, and hence the place where these trees are raised, is called a *nopalerie*. The plantations are generally established near the habitations of the Indians, by whom they are watched with jealous care, to prevent strangers from carrying off a breed of the insects or any of the plants on which they are raised. See DYEING and ENTOMOLOGY.

COCHLEARIA, SCURVY GRASS, a genus of plants belonging to the Tetradynamia class. See BOTANY.

COCK-PIT, a theatre in which the barbarous diversion of cock-fighting is exhibited. To readers in general it is perhaps not known that this practice, which may be truly styled savage, seems to have prevailed among all nations, and unfortunately has not been confined to those people whose manners and general character entitle them to a similar appellation. It was common among the ancient Greeks; Delos and Rhodes were famous for the breed of this kind of combatants, or for the fondness of the inhabitants for cock-fighting; and it seems to have been formed into an institution partly of a political and partly of a religious nature at Athens. The Romans derived the practice from the Greeks, and by that people it is supposed it was introduced into England. But the earliest notice of cock-fighting in this country is recorded by a historian who wrote in the reign of Henry II., from which time it has continued, and, it may be safely asserted, forms no amiable feature in the British character. But it appears that this diversion was disapproved and prohibited by the legislature in the time of Edward III. during the reign of Henry VIII., and by Oliver Cromwell in 1664.

COCKERMOUTH, a town of Cumberland in England, stands near the confluence of the rivers Cocker and Derwent, the former of which traverses the town, which is not very regularly built, but contains some spacious streets and excellent modern houses, and, with about 3000 inhabitants, has manufactures of leather, hats, woollen cloths, and coarse linens. The castle, now in ruins, erected on an artificial mound on the banks of the Derwent, seems to have been a place of some antiquity.

COCKROACH, a species of *blatta* which infests houses and ships in warm climates, and destroys almost every thing that comes in their way, and particularly clothes, papers, and books. Being introduced by ships from tropical regions, they are occasionally seen in this country. See ENTOMOLOGY.

COCOS, a genus of plants belonging to the order of Palms, and including under it the Cocoa-nut tree. See BOTANY.

COFFEA, a genus of plants belonging to the Pentandria class; and from the species *arabica*, the coffee of commerce is obtained. See BOTANY.

COHESION is that kind of attraction which exists between the particles of the same kind of matter, and otherwise called the attraction of aggregation. See CHEMISTRY.

COHORT, a military term among the ancient Romans, and including about 600 men. A legion was composed of ten cohorts, the first of which was not only more numerous, but always occupied the first place in dignity and honour.

COIMBRA, an ancient city of Portugal, about 31 leagues from Lisbon, is very agreeably situated on the banks of the Mondego, and is defended by walls and towers. The town at a distance presents an attractive aspect, but its interior is less pleasing; the houses are irregularly built, the streets are narrow, crooked, and dirty, and the accommodations and necessaries of life are ill furnished. The most considerable objects of Coimbra are, the University, which is attended by a great number of students, the Observatory, and the Botanic garden. Coimbra contains about 3000 houses, is divided into eight parishes, and has eight monasteries, and eighteen endowments.

COIN, a piece of metal which is employed as a circulating medium, and has certain impressions or marks stamped upon it for that purpose.

COINING is the art of making metal money, by impressing on its surface, or edges, certain marks or characters by which it is easily recognized to be legal and current coin. The art of coining, at least in any degree of perfection, may be considered as a modern invention; for although the coining press which is supposed to be the invention of a French engraver, was tried in Paris about the year 1553, and in a few years afterwards, in the time of Queen Elizabeth, was introduced into this country, yet it was afterwards laid aside both in France and England, as being a more expensive process than the hammer coinage, which continued to be practised in England till after the revolution. The coin produced in this way was called hammer-money, because it was formed by placing a *blank* or round piece of metal between two steel punches or dies, on which the design of the intended coin was engraved, and striking the upper die with a hammer.

From the time of William the Conqueror till within these few years, the coinage of England was conducted in the tower of London, by a corporation known by the name of the Mint, and composed of a number of officers, to each of whom the respective duties in the different operations were distinctly assigned, and the artizans or workmen employed were designated the *Company of Moneyers*. No department of human labour has been more successfully abridged and improved by the use of machinery than the art of coining. For these wonderful improvements, this country, as well as other nations who have adopted the same machinery, is indebted to the ingenuity of Messrs Bolton and Watt, who had long employed the same machinery for coining copper by contract

Coining.

at their works at Soho, near Birmingham. The steam engine is the moving power of their machinery, by means of which 20,000 pieces of money are produced in one hour, while the apparatus itself keeps an accurate register of the number of pieces struck. The attendance of four boys is all that is required.

The use of coining machinery, it is obvious, must be extremely limited, and the description of it can only be interesting to general readers as an object of curiosity; but, to the ingenious artist, it may be of considerable utility, as the means of suggesting hints for the application of similar inventions for abridging or facilitating the labour of man. The following is a description of the coining machinery exhibited in Plate 52.

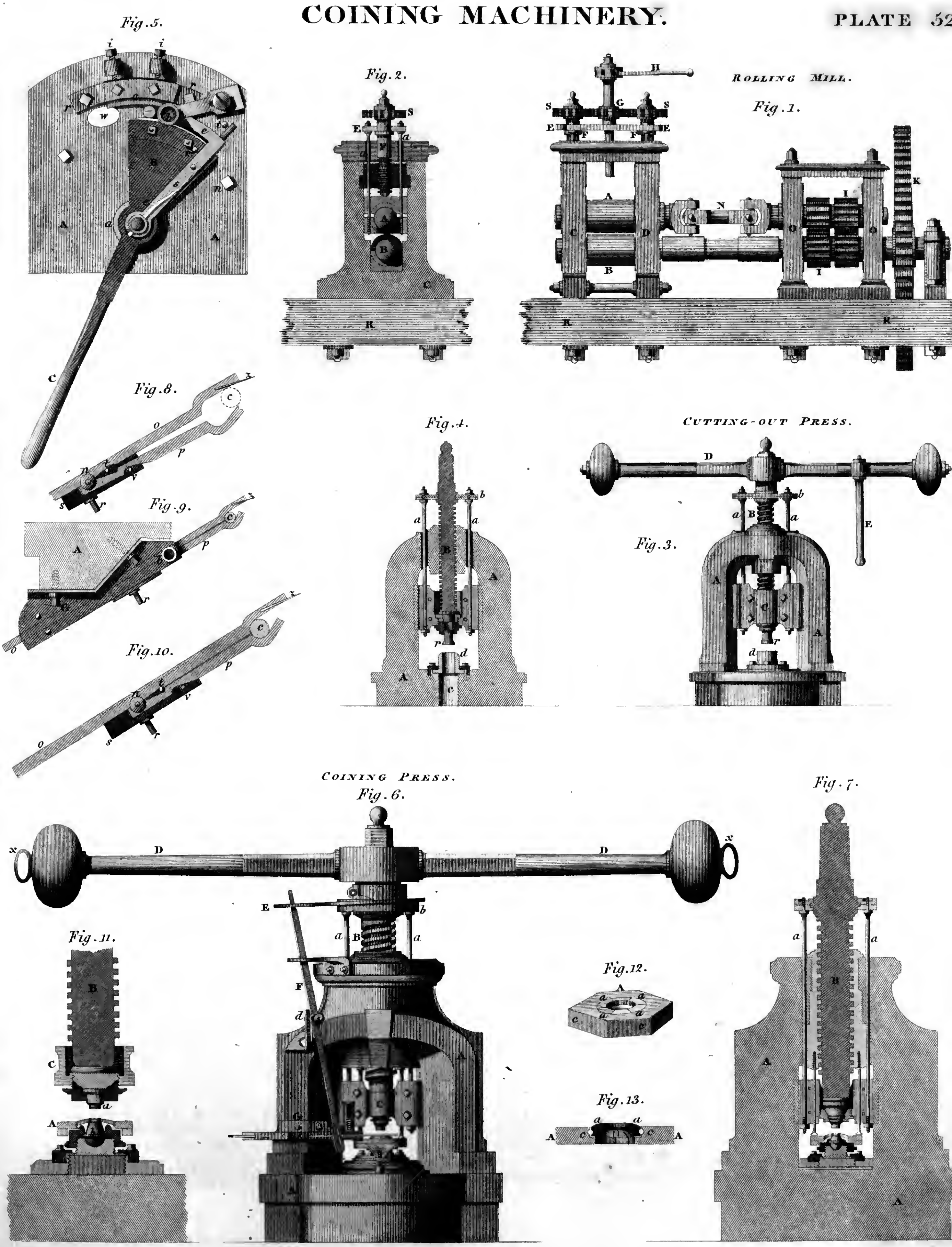
Figure 1. and 2. represent the machine for laminating the plates of gold or silver, called the rolling or flatting mill; Fig. 1. being an elevation, and Fig. 2. an end section of the same. A and B the two rollers, usually made of cast-iron in large machines; but in the machine in the present drawing they are represented made of steel, hardened and tempered, and turned or ground to a perfect cylinder: These rollers are mounted between two strong cast-iron frames or cheeks C D, which are bolted down to a horizontal beam of wood, R R; the pivots of the lower roller B, lie in brass bearings in the iron cheeks, while the pivots of the upper one A, with its brasses, are suspended by wrought-iron bolts *a a*, which pass up through the top of the frame, and are screwed into a collar or plate E, which encompasses the top of two large screws F F, only one being seen in Fig. 2. The lower ends of these screws bears on the upper brass of the roller A, whilst the bolts *a a* suspend the lower brasses of the same. The upper end of the screws F F, above the collar-plate, are formed into squares, each being furnished with a small cog-wheel S S, engaging in the teeth of a third wheel G; where it is evident, that by turning the wheel G round by the lever H, it will turn the two screws, F F, equal quantities of revolution, and raise or lower the upper roller A, equal to itself, according to the direction in which the lever H is moved; this movement regulates the distance between the surfaces of the rollers, and varies the thickness of the plates of metal which are passed through them. The two rollers are compelled to turn with equal velocities, by the pinions I I, mounted in an iron frame *o o*, nearly similar to the roller-frame, and are bolted down to the beam R R by four bolts. The axis N, which connects the upper roller and its pinion, has an universal joint in it, to allow for the different adjustments of the roller. Two pairs of pinions are shewn in the drawing, the space of one being opposite to the tooth of the other; by this combination they turn each other much more equally, as it is necessary the cogs should be large to be sufficiently strong. This machine is put in motion by the force of a steam-engine, water-wheel, or other mechanical power, turning the large cog-wheel, K, on the axis of the lower roller. After the plates of metal are rolled down to the required gauge by the above machine, the next operation is cutting out the blanks; this is performed by a machine called the cutting-out press, shewn at Fig. 3. and 4.; Fig. 3. being an elevation, and Fig. 4. a section of the same: A A is a very strong cast-iron frame, through the upper part of which a powerful screw passes; the top of this screw is made square, to receive the cross arm or lever D, furnished with a heavy weight at each end to serve as a fly. The lower end of the screw B carries the punch *r*, and is guided in its perpendicular motion by the piece C, sliding on angular ribs, within-side the cast-iron frame, suspended by two rods *a a*, passing through holes in the upper part of the frame, and caused to rise and fall with the screw by the collar *b*; the bottom of the frame has a round hole through it at *c*, over which the steel ring *d* is placed, and has a circular aperture, exactly fitting the end of the punch: The piece of metal to be cut out is laid upon the steel ring *d*, and the lever D turned round a small quantity, by the handle projecting downwards at E; this motion causes the screw to descend, with the sliding-piece *c*, forcing the punch through the metal, and cutting out a round piece of a sufficient diameter for the coin it is intended to make. The piece falls down through the opening *c* into a small drawer placed beneath the bench on which the whole machine stands. After the blanks are cut out, the lettering round the edge, or milling, is to be performed: Fig. 5. of the Plate shews a machine for the purpose, invented by Mr Genjambre; and used in the Mint at Paris, with great success; it is very perfect and expeditious in its operation: A A is a square cast-iron plate, about an inch thick, forming the base of the machine; upon this plate the sectoral piece B lies, and is capable of being turned round upon the centre pin *a*, a portion of a circle, by the tail or handle C. The die or piece of steel *c*, on which the letters are engraved, is formed to the segment of a circle round the centre pin *a*, and secured down by a clamp of iron *r r*, screwed to the plate A, and adjusted to its place by two screws *i i*. A piece of steel is screwed to the edge of the sector B, and accurately formed to the curve, leaving a distance between it and the die, *c*, equal to the diameter of the piece of money to be lettered or milled: The movement for placing the blanks or uncoined pieces of metal between the dies is very complete; the small sector *e e*, which lies upon the large one, turns freely round upon the centre pin *a*, and is made thicker at the arched part, so as nearly to fill up the space between the dies. The blanks are put into a short upright tube *b*, fixed to the plate A by a screw. The sector B performs the greater part of its motion independent of the small sector, which slides beneath the tube *b*, and prevents the blanks falling down between the dies, except in the position, when the sector B is brought to the stop *n*, fixed in the plate A; in that position the small sector is removed from beneath the tube by the short pin *r*, projecting up from the sector C; a single blank then falls between the dies, at a part where they are a little cut away or widened; and when the handle C is moved from left to right, the small sector is forced forwards by the light spring *s*, pushing the blank before it till the dies are sufficiently close to catch it; at that period, a projecting piece of the sector *e e* comes in contact with the fixed pin *t* in the plate A, and can go no farther; still leaving the sector B at liberty to move forward with the piece of money, forming the letters round its edge, and at

length, coming over the hole w in the bottom plate, the piece falls through, and is received in a drawer beneath. The handle C is then returned to take another piece, which is treated in the same manner. This machine, with the power of one man, to move the handle backwards and forwards, and for occasionally filling the short tube b with blanks, will letter 60 or 70 pieces per minute.

The next operation is that of striking the impression upon the piece. The machine for this purpose is very ingeniously contrived, and is called the coining press. Fig. 6. is an elevation of this press, and Fig. 7. a section. It has a strong cast-iron frame, A A, furnished with a screw B; a slider, C, to guide it in its motion, being suspended by two rods a a. The arm and weights D D are similar to the cutting-out machine in Figs. 3. and 4. but it is more powerful, and much stronger in all its parts, as the blow required to coin a piece of money is very great. The principal thing to be explained in this machine is the method of placing the blanks upon the die to be struck. Its construction is as follows: A curved plate of metal E is fixed on the screw B, just above the collar-plate b; this curve is in contact with the upper end of a lever F, whose center of motion is at d, in the iron frame A: and its lower end is attached to a long sliding plate, guided by a frame G, screwed to the main frame; this slider is called the tongs, and is shewn separate in Figs. 8. 9. and 10. A, Fig. 9. is a horizontal section of part of one of the cheeks of the press, with the frame G screwed against it, carrying the short tube b, into which the blanks are put to feed the press. The tongs slide across the bottom of this tube, and prevent the blanks falling down, except when the round part, or opening c, comes beneath the tube b, and the tongs are open, as seen in Fig. 8.; in that state a blank falls between them; as soon as the tongs begin to advance towards the die they close up, and hold the blank fast between them, carrying it forwards till it is exactly placed upon the lower die of the press; the tongs then open, as in Fig. 8. leaving the blank behind, in the position for being struck, and retire to fetch another piece from the tube b. The means used to open and shut the tongs is very simple; the lower end of the lever F has a groove in the direction of its length, which goes upon the pin r, Figs. 8. 9. and 10. This pin projects out from a square plate of metal s, which lies beneath the tongs, and has two small pins, t and v, rising up from its surface; the pin t enters into an angular groove, between the two arms o and p of the tongs, and the pin v bears against the outside of the arm p q. Suppose the tongs slided out from the center of the press, by the lever F, taking the pin r with its plate, and carrying the tongs back with it, till the opening c comes beneath the tube b, the tongs at this time are opened (as Fig. 8.) a blank falls down into the opening, and the plate s begins to advance by the motion of the lever F, when its pin, v, sliding against the small inclined plane on the outside of the arm p, closes the tongs, and embraces the blank; the plate s continues to advance, carrying the tongs forwards with it, till the blank is placed in the center of the press, upon the lower die; in that situation the plate s is drawn back by the lever and its pin t, acting in the angular groove, opens the tongs upon their center n, and then slides them out, leaving the blank in the position for being coined. This machine is put in motion by the power of four or five men, placed at the extremities of the arm D D, to move it backwards and forwards by means of leather straps fastened to the rings x x. A number of blanks are put into the tube b by a workman, who is situated in front of the press, so low that he can conveniently observe the dies; when the arm D is turned round in the direction to raise the upper die, the tongs advance by the lever F and curved piece E, to the center; and in turning the arm D in the reverse direction the tongs retire, leaving the blank behind them, which is coined by the momentum of the arm. When the tongs come forward with a second blank, they remove the piece which is coined from off the die, by the small projection at z. Fig. 11. shews the manner in which the dies are fixed; the upper one a is screwed or clamped to the sliding piece C, and quite detached from the great screw B, in order that the inequalities, or excentricity of the screw, may not be communicated to the die O. The lower die b is formed to a hemisphere on its under side, and fits into a corresponding figure in the piece which forms the bed of the press. The advantage of this construction is, that the lower die always adapts its surface parallel to the surface of the upper one, by which means the pieces are coined of an equal thickness in all parts, without that delicate adjustment which is found necessary when the die is placed upon a flat surface. Figs. 12. and 13. is a contrivance for lettering the edge of the coin at the same time that it is struck. It consists of a piece of metal A, of considerable thickness, formed to a hexagon on the outside, and turned out to a ring on the inside, as seen by the section Fig. 13.; into this ring six segments of steel a a a, &c. are fitted, leaving a hole in the center, exactly corresponding with the diameter of the coin, and fitting upon the neck of the lower die, as seen at A, Fig. 11. The steel segments are secured in their places by round pins, c c, half embedded in the metal A, and half in the segments Q. The letters or device intended to be formed round the coin are engraved in relief round the inside of the ring, formed by the pieces a a, &c.; the whole of this apparatus has the liberty of sliding up and down upon the neck of the die, and is moved by a lever, which is connected with the sliding piece C, in such a manner that it is sunk down upon the die, even with its surface, as seen in Fig. 11. when the tongs advance, and then rise up, forming a ring encompassing the blank during the time the piece is in the act of being coined. The blow required to give the impression expands the piece, and forces the metal on to the projecting letters round the inside of the steel ring; when the slider C rises up, it forces the ring down, leaving the coined piece upon the lower die at liberty to be pushed off O by the advance of the next blank. The segments a a move upon the pins c c, as centers, to allow the ring to descend, and are kept up by small springs placed beneath them.

COIX, Job's Tears, a genus of plants belonging to the Monoecia class, and including under it one species which has the whimsical name *Lácryma*

COINING MACHINERY.



Drawn by J. Farey for the Encyclopædia Edinensis, Engraved by W. & D. Lizars Edin^r.

Jobi, the seeds of which, about the size of a pea, are sometimes employed as ornaments, and used in some countries in times of scarcity as a substitute for bread.

COKE, Sir Edward, a most eminent lawyer, who held the office of Lord Chief-justice of England in the reign of James I. was born in the year 1550, at Mileham, Norfolkshire, the seat of his father, Robert Coke, Esq. a gentleman of good family, and a lawyer of great celebrity. At the age of ten he became the pupil of Mr Walter Howe, who at that time taught the free school of Norwich with reputation; from Norwich he went to Cambridge, and was admitted into Trinity college, where he remained four years, and was then removed to Clifford's Inn, and soon after was entered a student of the Inner Temple.

Here he soon displayed the penetrating perspicacity, and the discriminating judgment by which the whole of his legal career was so eminently distinguished, in so many and unexpected instances, as not only to attract attention and procure applause, but also to contribute to his being called to the bar at the unusually early period, *in those strict times*, of six years standing. We are told by himself that the first cause in which he was engaged in the court of Queen's Bench, was an action upon the statute *de scandalis magnatum*, brought by Lord Cromwell against Mr Edward Denny, vicar of Northlingham, in which, it would seem, from his promotion to the readership of Lyon's Inn immediately after, he had acquitted himself with approbation. During the three years in which he held this office his lectures were numerously attended, and his reputation as a man of great talents, and his practice as a lawyer, were daily increasing.

While a young barrister he paid his addresses to the daughter of Mr Paxton, whom he soon married, and received a fortune of L.30,000, high connections, and political interest. After his marriage he rose rapidly in his profession; the cities of Coventry and Norwich chose him their recorder; he was retained in all the great causes which were tried in Westminster-hall; was in high credit with the ministry of that time, and frequently consulted on the Queen's affairs; he was chosen knight of the shire by the freeholders of the county of Norfolk; he was made speaker of the Parliament held in the 35th of Elizabeth; in 1592 he was raised to the office of the Queen's solicitor, and very soon afterwards to that of attorney-general.

While he was thus in rapid progress to the highest and the most honourable stations in the state, he was destined to sustain a domestic calamity in the death of his wife, after she had brought him ten children. Having been a considerable time a widower, he married for his second wife the sister of the earl of Exeter, a union which is said to have been a source of inconveniencies and troubles to both parties. This marriage was celebrated in a private house, without either banns or license, in consequence of which both he and his lady, and her relatives, with the clergyman by whom the ceremony was performed, were involved in an ecclesiastical prosecution, and with difficulty escaped the greater excommunication. This inattention to the authority of the church is supposed to have arisen from inadvertence or ignorance of the mandates which archbishop Whitgift had that year issued to the bishops of his province, respecting irregular marriages.

The state trials, which occurred while he was attorney-general, of the earl of Essex, the earl of Southampton, sir Walter Raleigh, and others, gave full scope for the display of his oratorial powers, and of the accuracy and extent of his legal knowledge. But he has been blamed for his unnecessary harshness and severity towards the accused. In the vigilance, however, with which he watched over the safety of the state, and in the ability with which he conducted the prosecutions against the persons concerned in the *gun-powder plot*, he obtained, and was justly entitled to great applause. The earl of Salisbury declared, in his speech on the trial of Garnet, that "the evidence had been so well distributed and opened by the attorney-general, that he never before had heard such a mass of matter better contracted, or made more intelligible to a jury."

On the 22d of May 1603, when James I. on account of his quiet accession to the throne of England, entertained at Greenwich the principal persons of the kingdom, Mr Coke, along with the mayor and recorder of London, received the honour of knighthood. In 1606 he was made Lord Chief-justice of the court of Common Pleas; some years afterwards, the cause of which has not been assigned, he was removed to the situation of the Lord Chief-justice of the court of King's Bench; and in 1613 he was sworn one of his Majesty's privy council,—honourable offices, the duties of which he is said to have fulfilled with equal ability and integrity.

On his elevation to the station of Lord Chief-justice, Sir Francis, (afterwards Lord) Bacon, was raised to that of solicitor-general, and had long been his rival for honour and promotion; but the political conduct of the celebrated philosopher, even then tarnished with meanness and corruption, had provoked the indignation of the great lawyer, who had chosen for his motto, *The law is the safest helmet*, and adhered to it in every part of his life; and as he was aware that Bacon was using unjustifiable means to effect his disgrace and downfal, he addressed a letter to him, in which are these expressions: "I thought it best, once for all, to let you know in plainness, what I find of you, and what you shall find of me; you take to yourself a liberty to disable my law, my experience, my discretion; what it pleaseth you, pray think of me; I am one that know both mine own wants and other mens; and it may be, perchance, that mine mend, others stand at stay. And surely I may not endure in public place to be wronged, without repelling the same to the best advantage to right myself. I write not this to shew my friends what a brave letter I have written to Mr Attorney; I have none of these humours, but that I have written is to a good end; that is, to the more decent carriage of my master's service, and to our particular better understanding one of another. This letter, if it shall be answered by you in deed, and not by word, I suppose it will not be worse for us both."

But the sycophancy of Bacon proved a better recommendation to the king than the unbending honesty of Coke; and after he had risen into favour he used his influence for the destruction of his rival. The conduct of

Coll.

the chief-justice in regard to the trials of the earl of Somerset and the other persons concerned in the murder of Sir Thomas Overbury, and the part which he took in the discussions which arose about the king's prerogative, and the jurisdiction of the court of Chancery, and still more his opposition to Villiers, the king's favourite, contributed not only to withdraw from him the countenance of the king, but also to suspend him from the exercise of his office,—events which are said to have taken place in consequence of the misrepresentations of Bacon and the rest of his enemies. He was, however, sometime after this, reinstated in his place of privy counsellor, and the utmost deference paid to his opinions. But his steady adherence to the principles which he had adopted, and his opposition to the designs of the court, led to his being committed to the Tower, and to the taking possession of his papers; several charges were preferred against him, but none of them was prosecuted. In the year 1623, he was, with others, sent by the king to Ireland,—a commission which was regarded rather as a punishment than a favour, nor is it certain whether it ever was obeyed. In the Parliament of 1628, he was, much against his own inclination, elected sheriff of the county of Buckingham, and in the discharge of the duties of this office gave his warmest support to all those questions whose object was to promote the liberty of the subject, and to extend the privileges of the commons. He had a principal share in proposing and framing the *Petition of Rights*, and vindicated the power of the House of Commons to impeach and prosecute persons of the highest rank, and named Buckingham as the cause of all the calamities of the country.

About the year 1628, he retired to his seat in Buckinghamshire, wearied and disgusted with a public life, spent the evening of his days in peaceful retirement, and, in September 1534, he bade a final farewell to this world with all its troubles and all its distinctions. He had great quickness of parts, deep penetration, a faithful memory, and a solid judgment. These great powers he devoted to the study of the laws and customs of his country, in which he became profoundly learned. As a judge he was venerated for his dignity, talents, and integrity; as a servant of the crown, while he was careful to guard its just prerogative, he was at the same time vigilant to preserve the constitution of the country.

The works which he left behind him are,—Reports of Cases and Matters of Law, in 13 parts,—a Book of Entries, containing perfect and approved precedents of Counts, Declarations, &c.—Institutes of the laws of England, in four parts,—a Treatise of bail and mainprize,—the Complete Copyholder, &c.

COL or COLL, one of the Hebrides or Western Isles of Scotland, is about 13 miles long and 3 miles broad, contains about 1200 inhabitants who are employed in the fisheries, and in the rearing of black cattle.

COLBERT, JOHN BAPTISTE, marquis of Segnelai, an eminent statesman of France, was born in Paris the 31st August 1619, and was a descendant of a family of Scotch extraction that, first at Rheims and afterwards at Paris, had been engaged in the commerce of wine, cloth, and silk; and in some of these branches of trade, Colbert himself spent a part of his youth, and another part of it in the office of a notary. But in 1648, on the recommendation of John Baptiste, Lord of S. Pouange, his own relation, he was received into the service of Michael Le Tellier, secretary of state. In this situation his conduct was distinguished by ability, diligence, and fidelity, a singular instance of which is on record: He was sent by his master to Sedan, to show Cardinal Mazarine, who was there, a letter written by the queen mother, with strict orders to bring it back after it had been perused by that minister; but the cardinal wishing to retain this royal epistle, endeavoured by menaces to prevail on Colbert to return without it; this, however, he positively declared he would not do, and actually waited several days, till he regained the possession of it. Not long after this event, Mazarine having applied to Le Tellier for a person to write out his memorandums, Colbert was introduced to him for that purpose. During their first interview, the Cardinal mentioned that he had some recollection of having somewhere seen him before, and asked Colbert to inform him where they had met; and on being reminded of his having brought him the queen's letter to read, he was so far from resenting his attention to his master's orders, or his persistive importunity in demanding the letter to which he was thereby led, that he said he would employ him on condition of his serving him with the same fidelity and zeal.

Colbert.

The uprightness of his conduct in this capacity, and the dexterity with which he accommodated himself to the inclinations of his patron, soon procured him a large share of his favour, as a proof of which he was entrusted before he had been long in his employment with the management of the gainful trade of selling benefices and governments. Nor did he disdain to ask his opinion or to follow his advice. Through his suggestion the governors of frontier places were obliged to maintain their garrisons with the contributions which they levied from them; he was sent to Rome to negociate the reconciliation of Cardinal de Retz; and from the good opinion with which the cardinal impressed the mind of Lewis the XIV. of his talents and integrity, he was made intendant of the finances, which at that time had fallen into confusion, but which, under his skilful management, were soon restored to a flourishing condition. He also established the French East and West India trade, from which his country derived so many advantages.

In 1664 he was made superintendant of the public edifices of the kingdom; and, in this office, he displayed the magnificence of his public spirit, by the great improvements which he immediately commenced. He extended and adorned the Tuilleries, the Louvre, St Germain, Fontainbleau, Chambord, and still more Versailles, all of which owe to him much of their present splendour. He also enlarged and otherwise improved the metropolis, which set the example of improving the provincial towns throughout the country. Through his means the academy of painting and sculpture was established by patent about the same time, to which was attached an historiographer, with an annual salary of 300 livres. The erection of the royal Observatory of Paris, which was first conducted by the celebrated Cassini, and which has so essentially contributed to the advancement of science, was also owing to Colbert. The canal of Languedoc, by which the two seas are united, was in 1660 begun by his suggestion, and in 1680 it was completed under his auspices. The reformation of the irregularities which had crept into the courts of justice, the suppression of usurped noble titles then common in the kingdom, and the regulation of a variety of matters of inferior importance, at the same time claimed and obtained a portion of his regard.

In 1669 he was appointed secretary of state, and intrusted with the management of naval affairs, in which he acquitted himself with his usual ability. He suppressed a number of useless, but expensive offices, regulated the procedure of the criminal courts, and obtained an edict for erecting a general insurance office at Paris, for the benefit of the merchants. In 1672, he was made minister of state, for which his capacity was well calculated, and in which he conducted himself greatly to his own credit and his country's advantage.

Of Colbert's impatience of interruption while engaged in business, to which his time was so entirely devoted, the following anecdote is told. A lady of great quality was one day urging him to do her some piece of service, when his attention was absorbed by some other object, deemed by him of greater importance. On observing his inattention to her suit, she, although there were more than an hundred persons present, threw herself at his feet, and exclaimed, "I beseech your greatness, in the name of God, to grant me this favour." Upon which Colbert kneeled down immediately opposite to her, and replied in the same plaintive tone, "I conjure you Madam, in the name of God, not to disturb me."

This great statesman finished his mortal career on the 6th of September 1683, in the sixty-fifth year of his age. In his personal appearance, Colbert was of the middle stature, and of a slender form; his hair was black and scanty; his air was dejected, and his countenance was stern. He required little sleep, and was extremely temperate. He was well acquainted with business, and pursued it with unwearied application, and filled the most important offices of government with much reputation to himself and advantage to his country. Its finances, its navy, and its commerce, its arts and its sciences, are under great obligations to him for the regulations which he introduced, and for the institutions which he established. He invited to France, painters, sculptors, mathematicians, and artists of all descriptions; and even gave donations, and procured pensions for men of genius of other countries.

He married early, and left behind him six sons and three daughters; and, immersed as he was in public business, and occupied with political schemes, he never lost sight of the interest of his family, or of an opportunity of promoting its aggrandisement, so that he left his offspring independent of princes favours, and creditably and even splendidly settled in life.

COLCHESTER, a town of Essex in England, stands on the banks of the Colne, was a place of importance in the time of the Romans, contains more than 12000 inhabitants, is distinguished by some venerable ruins, which exhibit undoubted marks of former magnificence, and can boast of some elegant public and private edifices. Baize, serges, and other woollen cloths, with some silk stuffs, are stated as the chief manufactures; and the river, which is navigable for small vessels close to the town, affords facilities for commercial intercourse. The trade in oysters, which are supposed to be of a superior quality, is considerable.

COLCHICUM, MEADOW-SAFFRON, a genus of plants belonging to the Hexandria class.

COLCHIS, an ancient kingdom of Asia, situated to the eastward of the Euxine sea, and to the northward of Armenia and Pontus; is supposed to have been originally colonized by a branch of the Cushites, and at a later period by part of the army of Sesostris king of Egypt, when he carried his victorious arms to that region; is said to have been remarkable for poisonous plants, but this is probably a fabulous or exaggerated story; and was fruitful in flax, hemp, wax, and various kinds of timber. Colchis is also famous in history for the expedition of the Argonauts, prompted, it is supposed, by the mines of gold with which the territory was supposed to be enriched, and celebrated both by Greek and Roman poets. The modern name of Colchis is *Mingrelia*.

COLCOTHAR is the substance which remains after the calcination of green copperas, or sulphate of iron, and is employed for painting.

COLD, in the strict meaning of the term, denotes the sensation which is produced by the abstraction of heat from the body when it is brought into contact with a body of inferior temperature; but in common language it is considered as a distinct principle, in opposition to the principle of heat or caloric; and even some speculative philosophers of the present day seem disposed to adopt the doctrine as implied in this latter acceptation of the term. See CHEMISTRY.

COLEOPTERA, the first order of the class of insects, according to the Linnæan system, and so called from the covering of the wings. See ENTOMOLOGY.

COLERAINE, a borough town of the county of Londonderry, in Ireland, stands on the banks of the river Bann, about four miles from its junction with the sea, contains about 5000 inhabitants, and is famous for its salmon and eel-fisheries.

COLLEGE, in its most general acceptation, denotes an assemblage of several persons, or several bodies in one society. Among the Romans this term was applied to those who were employed in the offices of religion, of government, and of arts and trades; and seems to have been equivalent to company or corporation in modern times. It is also a term employed in the church of Rome, as the college of Cardinals, or the Sacred college; in the political constitution of Germany, as the college of Electors; is used for a public place endowed with certain revenues, where the different branches of education are conducted,—and when a number of colleges of this latter description are united, an *University* is constituted; is applied to certain corporations, as the college of Physicians or of Surgeons; and to some other institutions, as the college of Jus-

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tice, which is the supreme civil court of Scotland, and the college of Heralds, usually denominated the Herald's office.

COLLINS, William, an English poet, was born at Chichester in December 1720, was educated at Winchester school, and about 1740 entered Magdalene college, Oxford, where he remained till he obtained a bachelor's degree, and then suddenly left the university. He visited London about the year 1744, and appeared on this great theatre for the display of talent as a literary adventurer; but before he left the university he had published his Oriental Eclogues, and perhaps flattered himself with hopes of success from the reputation which these productions had obtained. But as he had nothing to depend upon for his existence but his literary exertions, and as his resolution and industry seem to have possessed little vigour, he was soon involved in pecuniary difficulties, from which he was relieved by an application to booksellers, who on the credit of a translation of Aristotle's poetics, which he undertook to write with a commentary, advanced as much money as enabled him to escape into the country. Before this time he published proposals for a History of the Revival of Learning, and it is said he planned several tragedies; but it is supposed that no part of the history, and it appears that none of the tragedies were ever written. He was soon after put in possession of a legacy of L.2000, left him by an uncle, and out of this sum he repaid the booksellers what they had advanced, and abandoned the translation.

The life of Collins seems hitherto to have been harassed with poverty, but now that he had reached comparative affluence, it was assailed by distresses of another kind, more severe and aflicting in their nature. For several years he languished, as his biographer expresses it, under that depression of mind which enchains the faculties without destroying them, and leaves reason the knowledge of right without the power of pursuing it. These clouds which he perceived gathering on his intellects he endeavoured to disperse by travel, and passed into France, but found himself constrained to yield to his malady, and returned. He was for some time confined in a house of lunatics, and afterwards retired to the care of his sister at Chichester, where he died in 1756, and at the early age of thirty-six.

Dr Johnson saw Collins at Islington after his return from France, and at that time nothing of disorder was discernible in his mind by any but himself; but he had withdrawn from study, and travelled with a single book only, which was the English Testament; and when curiosity led his friend to see what companion a man of letters had chosen, the poet remarked, "I have but one book, but that is the best."

His disorder, says Johnson, was no alienation of mind, but general laxity and feebleness, a deficiency rather of his vital than his intellectual powers; what he spoke, wanted neither judgement nor spirit, but a few minutes exhausted him so that he was forced to rest upon the couch till a short cessation restored his powers, and he was again able to talk with his former vigour. The approaches of this dreadful malady he began to feel soon after his uncle's death, and, with the usual weakness of men so diseased, eagerly snatched that temporary relief with which the table and the bottle flatter and seduce; and as his health continually declined, he grew more and more burdensome to himself. But his biographer has stated that his morals were pure and his opinions pious; that he preserved the source of action unpolluted; that his principles were never shaken; that his distinctions of right and wrong were never confounded; and that his faults had nothing of malignity or design, but proceeded from some unexpected pressure or casual temptation.

Colman.

Dr Johnson has pronounced Collins to have been a man of extensive literature and of vigorous faculties, acquainted not only with the learned tongues, but with the Italian, French, and Spanish languages; and he has characterized his poems as the productions of a mind not deficient in fire, nor unfurnished with knowledge, either of books or life, but somewhat obstructed in its progress by deviation in quest of mistaken beauties; and it is added that his diction was often harsh, unskilfully laboured, and injudiciously selected; he affected the obsolete when it was not worthy of revival, and he puts his words out of the common order, seeming to think, with some later candidates for fame, that not to write prose is certainly to write poetry. But from this opinion it is probable many readers will be disposed to dissent when a reference is made to the Ode to the Passions, and the verses on the death of Thomson, which, in energy of thought, force of language, sweetness, tenderness, and simplicity, will bear a favourable comparison with any composition in the English language. *Johnson's Life of Collins.*

COLMAN, George, a dramatic and miscellaneous writer, was the son of Mr Colman, British resident at Florence, where he was born in 1733. By the mother's side he was connected with the noble family of Bath. He was educated at Westminster school, and afterwards at Oxford, and had for his cotemporaries Lloyd, Churchill, and Bonnel Thornton, with the latter of whom he brought forward the Connoisseur, a weekly periodical work, which was afterwards published in four volumes, 12mo. After the requisite studies, he was admitted to the bar, but seems never to have seriously prosecuted the profession of the law. The bent of his inclination led him to general literature, and particularly dramatic writing. He succeeded Foote as the proprietor of the Haymarket theatre, and furnished it with his own productions, either as translations or original works. After a stroke of the palsy in 1789, he lingered till 1794, when he died in the 61st year of his age. Besides the comedy of the *Jealous Wife*, the *Clandestine Marriage*, the latter in conjunction with Garrick, and some other humorous pieces for the stage, he was the author of a translation of the *comedies of Terence*, and of *Horace's Art of Poetry.*

COLMAR, a town of the department of the Upper Rhine in France, stands in a fine plain near the foot of a mountain, and near the confluence of two streams with the river Ill; is surrounded with a wall; contains more than 13,000 inhabitants, who are employed in the manufacture of woollen stuffs, calicoes, stockings, and hardware, and have a considerable trade in the corn and wines of the surrounding territory.

COLNE, a town of Lancashire in England, stands on an elevated ridge near the Foulridge tunnel, on the Leeds and Liverpool canal; contains more than 5000 inhabitants, and seems to have been a place of considerable antiquity. The chief manufactures are cotton stuffs, and particularly dimities and calicoes.

COLOGNE, formerly an electorate of Germany, is now included in the duchy of the Lower Rhine, and, since the French revolution, has been assigned to Prussia. The length is about 30 miles, and the breadth about 15; and the number of inhabitants exceeds 200,000. The Rhine, which is joined by the Aar, and some other tributary streams, is the principal river. The upper part of the province is clothed with extensive forests; but in the lower districts corn and flax are abundant.

COLOGNE is the capital of the electorate or province of the same name, stands in a flat country on the left bank of the Rhine, and is built in the form of a crescent, with walls and towers, including a space of seven miles in circumference. The streets are narrow and irregularly disposed; some of the churches are remarkable for their grandeur and antiquity; and the university, which was established about the end of the 14th century, was suppressed while the town was under the dominion of the French. The number of inhabitants in 1802 was stated at 39,000; but in this number are included swarms of beggars, who flock to this place from all quarters.

The principal manufactures are woollen and silk stuffs, thread and lace. The situation of Cologne presents many local advantages for commercial intercourse; it was formerly one of the four principal Hanse towns, and in the 13th century enjoyed a considerable trade with England. Wine, timber, slates, earthen-ware, fire-arms, and various kinds of hardware, are the chief exports. The vicinity of Cologne to the Rhine has exposed it greatly to inundations of that river; in the beginning of the year 1784 it suffered severely from that disastrous calamity. Cologne, which, with the surrounding territory, was assigned to Prussia in 1814, is 20 miles south-east from Dusseldorf, and 95 miles north-west from Frankfort on the Maine.

COLONSAY, one of the Hebrides, or western isles of Scotland, and including Oransay, from which it is separated by a narrow sound, dry at low-water; is about 12 miles long and two miles broad; contains about 800 inhabitants, and some excellent arable and pasture land.

COLONY, in its proper signification, denotes a number of persons who have removed to some remote place for the purpose of forming a permanent settlement. In its original acceptation, the word, as it is derived from the Latin, *to till or cultivate*, was applied to a body of farmers who were sent to cultivate the ground in a distant region, and it has passed with little alteration into the modern languages of Western Europe. Four kinds of colonies are distinguished; first, those that are established from an excess of the population of any country; second, such as are established in a vanquished country by a victorious prince; third, those that are formed by emigrants, who have been driven from their native land by oppression or persecution. The fourth description of colonies refers to those which are undertaken for commercial purposes, of which many examples are well known among all European nations.

COLOSSUS, a term which is applied to statues of a larger size than what is natural. Of statues of this description, the most remarkable recorded in history was a brazen statue of Apollo, which was set up at the entrance of the harbour of Rhodes; it was reckoned one of the wonders of the world; the height exceeded 100 feet, so that ships could pass under it with their sails set. This extraordinary statue was the workmanship of Chares, a disciple of Lysippus, who was occupied twelve years in its construction, and it was thrown down by an earthquake 224 years before the Christian era. For the purpose of replacing it, embassadors were dispatched to all the princes and states of Greece to solicit assistance; the money collected was applied to other uses, and the Colossus lay neglected for several hundred years; and the emperor of the Saracens having reduced Rhodes to subjection, broke down the statue, and sold the fragments to a Jewish merchant, who, it is said, loaded 900 camels with the metal. The base of this statue was of a triangular form; the extremities were supported by sixty pillars of marble, and a winding staircase led to the summit. Colossal statues were not uncommon at Rome, of which two represented Jupiter, an equal number represented Apollo, one was a statue of Nero, and another of Domitian.

COLOUR is that property of light which produces different effects on the organ of sight, and affects the mind with different sensations. See OPTICS.

COLOUR, in dyeing and calico-printing, see DYEING.

COLOURING, the method of applying and managing the colour of a picture, or those mixtures of light and shade which are formed in the various colours employed in painting. See PAINTING under DESIGN.

COLUBER, a genus of serpents belonging to the order of Amphibia. See OPHIOLOGY.

COLUMBA, THE PIGEON, a genus of birds belonging to the order of Passeres. See ORNITHOLOGY.

COLUMBA, ST. the founder of the monastery in Iona, one of the western isles of Scotland, was a native of Ireland, and left his native country about the year 555, for the purpose of converting the inhabitants of these islands to the Christian faith; although it is said he was driven from his own country by persecution. Iona was thence called I-columb-kill, or the cell of Columba. The same Columba was greatly distinguished by the sanctity of his manners; was high in favour with the Pictish king, and lived to a great age. He was buried in Iona, according to the Scottish historians; but, according to another account, his remains were afterwards conveyed to Downe, in Ireland.

COLUMBIUM, a metallic substance, which was detected in a mineral from North America, the discovery of which belongs to modern chemistry. See CHEMISTRY.

COLUMBO, the capital and the seat of government of the island of Ceylon, stands on the south-west part of the island, is regularly built, and divided into four equal quarters, and has two principal streets, which cross each other at right angles, and extend the whole length of the town. Columbo approaches more nearly to the European style of building than any other garrisoned town in India. The fort stands on a peninsula projecting into the sea, is more than a mile in circumference, and is well secured both by nature and art. The public buildings and store-houses are commodious and spacious, and the roadstead affords safe anchorage to ships from December to April. The population of Columbo, which has not been particularly specified, is composed of persons from every part of the east, beside the Europeans and native inhabitants. The surrounding territory, which is flat and covered with a rich soil, is finely diversified with fields of rice and pasture grounds, and interspersed with woods and groves, in which cocoa-nut and cinnamon trees appear conspicuous.

COLUMBUS, CHRISTOPHER, (or, as he is called by the Spaniards, *Christoval Colon*,) one of the most celebrated maritime discoverers of modern times, was by country a Genoese, was born about the year 1442, but in what particular place of the Genoese territory is uncertain; and although he appears to have been of humble extraction, his parents were probably not in indigent circumstances, for they gave him a good education, which well qualified him for the profession to which he was destined. His mind, naturally quick and vigorous, was improved by the acquirement of the Latin language, the sciences of mathematics, geography, astronomy, and navigation, and he was early taught the art of drawing. In his fourteenth year he first encountered the dangers of a sea-faring life, to which he ever after enthusiastically adhered; and his first voyages were confined to the Mediterranean, where he was probably employed in the Levant trade.

When he was about twenty, he engaged in a voyage of discovery towards the north pole, the object of which was to ascertain whether the frigid zone was habitable, as the opinion of the ancients, that these zones were incapable of supporting animal life, still prevailed. He sailed about 100 leagues to the north of Iceland, the ancient *Thule*, the northern side of which he placed erroneously in 73° north lat. Hence as Iceland does not extend within the arctic circle, he did not, as he supposed, prove that the north frigid zone was habitable, as the discoveries of future voyagers have fully demonstrated.

On his return from this voyage, Columbus engaged in the Genoese service, in some privateering cruises against the Turks and Venetians; and here he displayed much of that skill and courage, for which he was afterwards so eminently distinguished. One instance of his intrepidity is particularly noticed by his biographers. Cruising about two leagues from the harbour of Lisbon, the fleet to which his vessel belonged fell in with some Venetian gallies, returning richly laden from the coast of Flanders. In the heat of the engagement which ensued, the vessel in which Columbus sailed grappled with one of the Venetians, and in a short time took fire. Columbus who had fought bravely, now threw himself into the sea, and, assisted by an oar, swam with great coolness till he made good his retreat, and gained the land.

The hardships to which he had been exposed in these cruises having impaired his health, he went to Lisbon, where he soon married a Portuguese lady, the daughter of a naval officer in the service of Don Henry, Prince of Portugal. This connexion led him to fix his residence at Lisbon, and to consider himself a subject of Portugal. At this period the Portuguese, under the auspices of their learned and enterprising prince, were prosecuting those maritime discoveries along the coast of Africa by which they finally ascertained the practicability of proceeding by sea to the East Indies. Columbus, whose mind was constantly bent on enterprise, and who had become possessed of many valuable charts and journals belonging to his father-in-law, now began to conceive the idea of finding a passage to India by a more direct route than that which was then anticipated round the southern point of Africa. Reasoning from what he had learned of the geography of the globe, as it was then known, and encouraged by the advice and observations of Paul, a learned physician of Florence, he was convinced that, by holding a direct course towards the west, a ship would in no long time reach the eastern coast of Asia, or fall in with some unknown land, which would form an interesting and profitable object of discovery. Aware of his own qualifications for such an enterprise, he sought only for that patronage which could furnish him with the means of realizing his purpose. But this he long sought in vain. He first applied to the government of Genoa, his native country, but the Genoese were satisfied with the commerce which they carried on with India at second hand; he next offered his services to his new masters the Portuguese, but they were too much engaged in their southern expeditions; and the idea of sailing with safety to the west was ridiculed and inveighed against, by the only men among them who had any pretensions to learning, as the dream of a madman, or the presumptuous undertaking of a heretic. Baffled but not discouraged, Columbus now sent by his brother Bartholemew an offer of the honour and profit that must accrue from the enterprise to Henry VII. of England; but that monarch, either withheld by his avarice, or dissuaded by the refusal of other potentates, turned a deaf ear to his proposal; and the honour of patronizing the enterprise, and the empire to which it paved the way, fell to Isabella, who then, in concert with Ferdinand of Arragon, swayed the Spanish sceptre.

Being admitted into the presence of this princess, he not only contrived to render himself agreeable to her by his manners and deportment, but convinced her it would be greatly to the advantage of the Spanish monarchy that he should, under her auspices, be dispatched on the proposed expedition. The terms on which he engaged to undertake it were equitable but manly. He was to be appointed admiral of all the seas whither he was about to transport the Spanish flag, and governor of all the lands which he might discover—dignities which were to be hereditary in his family; and he was to be allowed the tenth of every thing that should be sold or found in these places, after deducting the charges of the expedition. In the meantime he promised to contribute a sum sufficient to defray the eighth part of the whole expence. After much negociation and delay, he was at length enabled to put to sea with three vessels, called the Santa Maria, which carried the Admiral's flag, the Pinta and the Nina, which were victualled for 12 months, and all together had on board only 90 men. The whole expence of this equipment is said not to have exceeded L.4000.

Having sailed from Palos in Andalusia on the 3d of August 1492, and refitted at the Canaries, he left these islands on the 6th of September, and passed into an unknown and apparently boundless ocean. Guided by the compass, and favoured by the tradewind, he pursued his course without accident for about 8 days, till he had stretched about 200 leagues west of the Canaries. Here he found that he could no longer depend implicitly on the magnetic needle, the variation of which was now first observed. His crew were greatly alarmed at this phenomenon, but Columbus, with that admirable presence of mind, which so strongly marked his character, contrived to quiet them by a plausible explanation of the circumstance, and to keep alive their hopes by remarking occasionally indications of their approaching land. But it was with the utmost difficulty he could repress the mutinous spirit of the sailors when they found, that after continuing a westerly course for about a month, they were still distant from the object of their wishes. At length, on the 12th of October, they made the Bahama islands, about 3000 miles west of the Canaries. Columbus went on shore and ingratiated himself with the inhabitants and their chief, built a fort upon the coast, and took possession of the island in the name of the Spanish government. Columbus remained among the islands in the gulph of Mexico till March 1493, when he set sail on his return to Spain, and, after encountering a tremendous storm, he cast anchor in the harbour of Palos, about seven months after he had left it. He afterwards made two other voyages to the West Indies, and in the last discovered the continent of America. On his first return to Spain, he was ennobled by Ferdinand, and received all the privileges of a grandee of Spain; but as envy is inseparable from merit and exalted station, he soon fell into disgrace, and was brought home from Hispaniola to Spain as a prisoner. Though soon restored to the favour of his sovereigns, he was superseded in his post of governor of Hispaniola, and did not long survive this unjust treatment. He died at Valladolid in 1506, probably in the 64th year of his age, and was buried with great pomp by Philip, the successor of Ferdinand and Isabella. He left two sons, of whom the elder, Don Diego, succeeded him as high admiral, &c. of the American seas.

Columbus possessed all the qualifications that could fit him for a navigator. Bold, enterprising, hardy, prudent, sanguine, but cautious, he planned with judgment, and executed with decision. That the merit of having discovered even the continent of America is due to him, is no longer doubted by those who are acquainted with the history of geography and navigation. For a most interesting narrative of these voyages, see Robertson's *History of America*.

COLUMELLA, Lucius Junius Moderatus, an ancient writer on rural affairs, was a native of Cadiz, and flourished at Rome in the time of the Emperor Claudius, or about the 42d year of the Christian era; is chiefly known by his work, *De re rustica*, in 12 books, which treat of the culture of various vegetables, and of the management of domestic animals; and to which is added a separate book, *de Arborius*. The best edition of the works of Columella is in *Gesner's Collection of Writers on rural affairs*.

COLUMN, a round pillar composed of a shaft, base, and capital, and intended for the support or ornament of an edifice. See Architecture.

The word column, with some distinctive epithet expressive of its use, is applied to various other structures of a similar description; and, in military affairs, it signifies a body of troops arranged in a particular way.

COLURES, are two great circles supposed to intersect each other at right angles in the poles of the world, and to pass through the solstitial and equinoxial points of the ecliptic; and hence one is called the solstitial, and the other the equinoxial colure.

COLUTEA, Bastard or Bladder Senna, a genus of plants belonging to the Diadelphia class, and including a considerable number of species which are chiefly shrubby plants.

COLYMBUS, a genus of birds belonging to the order of Anseres, and including the guillemot, the diver, and grebe. See Ornithology.

COMA, a term in medicine which denotes a preternatural propensity to sleep, and is the consequence of some injury or oppression of the brain. When this kind of stupor is accompanied with sleep it is called *coma somnolentum*; and when the patient is isturbed with dreams, it is called *coma vigil*.

COMARUM, Marsh Cinquefoil, a genus of plants belonging to the Icosandria class.

COMBAT, in its general signification, denotes an engagement with hostile weapons between two parties. According to some authors, when the word is applied to two armies, it signifies a partial engagement or skirmish. But the word combat is also expressive of a form of trial between two champions in some doubtful cause or quarrel, and hence it is called *single combat*. Proceeding on the presumption, that an overruling providence would only permit the party who had the rightful cause to be victorious, this form of trial was common among barbarous nations, both in criminal and civil cases; the accuser having first sworn to the truth of the charge, the accused gave him the lie, upon which each threw down a gage or pledge of battle. It would appear that the law of England is not obsolete on this point; for, by a solemn decision of the Court of King's Bench, in the present year 1818, this mode of trial was allowed to Abraham Thornton, who was charged with the murder of the sister of the accuser. Thornton had been tried and acquitted at the assizes for the county in which the deed was committed, and a new charge being brought forward by the brother of the deceased, had this issue which it may surprise many readers to have been a possible event in the enlightened period when it happened.

COMBINATION denotes an assemblage of several things united two and two, but as a mathematical term it signifies the variation or alteration of any number of quantities, letters, sounds, or the like, in all the different manners possible.

COMBINATION is a term in chemistry, signifying the union of two bodies of different natures, from which a new compound is obtained; as when an acid and alkali are combined, a neutral salt, with entirely new properties, is the result.

COMBUSTION, or Burning, is the decomposition of certain substances, accompanied with heat and light, by which they acquire new properties. See Chemistry.

COMEDY is a kind of dramatic poetry, which gives an allegorical representation of some interesting and characteristic event in private life.

COMET, a heavenly body in the planetary region, which appears suddenly and again disappears, and moves like a planet, but in a very excentric orbit. The nature, motions, and periodical revolutions of comets, have employed and occupied the attention of philosophers and astronomers both in ancient and modern times. See Astronomy.

COMETARIUM, a machine constructed for exhibiting the motions of comets round the sun. It was first invented by Dr Desaguliers, but has been greatly improved by the ingenuity of instrument makers.

COMITATUS, the Latin term for a county, a division of England first adopted by king Alfred. The counties were divided into hundreds, and the hundreds into tythings.

COMITIA, from two words which signify *to go together*, were the assemblies of the Roman people for the election of magistrates, or for deliberating on the affairs of the republic. Certain days, called Comitial days, were fixed for the meeting of these assemblies. Three kinds of Comitia are described, according to the manner in which the people gave their suffrages; as by *curiæ*, or parishes, which were called *comitia curiata*, first instituted by Romulus; by tribes, of which the assemblies were called *comitia tributa;* or by centuries called *comitia centuriata*, which had their origin in the time of Servius Tullius.

COMMANDINE, or Commandinus, a learned mathematician and classical scholar of the 16th century, was born at Urbino in Italy in 1509, and, under the patronage of the duke of that place, he translated some parts of the works of Archimedes, the Conics of Apollonius, and the Elements of Euclid, from the original Greek into the Latin language; he was also the author of some works on mechanical philosophy, and his Elements of Euclid were long employed as a text book in the schools. He died in 1575.

COMMANDERY, a benefice or fixed revenue, belonging to a military order, and conferred on such knights as had contributed by their services to the advantage of the order. The knight on whom such benefices were conferred was called Commander, and some of them, as the commander of Malta, possessed at one period considerable power and political influence.

COMMENSURABLE, a geometrical and arithmetical term, denoting such quantities or numbers as are measured by the same common measure; when applied to numbers, it signifies such integers or fractions as can be divided by another number without remainder, as 12 and 18, which are measured by 6 and 3.

COMMERCE is a term which is usually restricted to the mercantile intercourse between different countries, while similar transactions between different parts of the same country is called *trade*.

COMO, a town of the Milanese in Italy, stands at the southern extremity of the lake of the same name, is surrounded with hills, some of which are finely wooded, excepting towards the lake, and seems to have been greatly distinguished by its magnificent villas, temples, and porticoes in ancient times. In its present state, Como is still remarkable for its splendid edifices, particularly the cathedral and some other churches. The number of inhabitants is stated at 20,000, and they are occupied in manufactures of cotton, silk, and velvet. Como is celebrated as the birth-place of the younger Pliny; it is 20 miles north from Milan.

The lake of Como, *Lacus larius* of the ancients, in the vicinity, extends about 50 miles between two chains of mountains at the foot of the Alps, varies in breadth from three to six miles, and while it is 50 feet deep in some places the depth in other places is not less than 600 feet. It is of a serpentine form, indented with numerous creeks and harbours, subject to sudden squalls and swells, and encompassed with mountains clothed with olives, vines, and orchards, groves of chesnuts, and forests of fir and pinetrees; but the sides of this elevated tract are diversified with plains fit for culture, and on which are situated numerous towns and villages. Mines of iron, lead, and copper, have been wrought in this territory, and from its marble quarries Milan and the neighbouring cities are furnished with the materials and ornaments of their magnificent edifices.

COMORA ISLES, a cluster of islands in the Mozambique channel, between the coast of Zanguebar in Africa, and the northern extremity of Madagascar, are five or six in number, and situated between the 10th and 14th degree of south latitude. These islands, which are inhabited by negroes of the Mahometan religion, abound in cattle, sheep, and hogs, and produce all the varieties of tropical fruits, and hence afford a convenient station for the refreshment of ships trading in those regions. Comora the largest of the groupe, is about six leagues long and three broad.

COMORIN, CAPE, the southern extremity of southern Hindostan, lies north west from the island of Ceylon; and although this promontory be not more than nine miles in extent, the mountainous ridge of the Ghauts, by which it is traversed, presents on its opposite sides very different seasons at the same time; for while the trees and plants of the south side are in full bloom or loaded with fruit, the same kinds of plants on the north side are stripped of their leaves.

COMPANY, derived through the French from the Latin, and literally signifying to eat bread together, is an assemblage of several persons in the same place, and having the same purpose in view, and is applied to associations of different kinds, as the several professions and trades exercised in the city of London, which are called Companies, and to an association of merchants, who unite in one common interest, and contribute, by their stock, to support and promote the advantage of the parties concerned. A private association of merchants is generally denominated a partnership; but a company is understood to be an association enjoying certain exemptions, and possessing exclusive privileges, confirmed to them by letters patent, charters, or some other public deed granted by legislative authority; for examples of which reference may be made to the English East India Company, first established in the year 1600; the African Company, instituted about the same time; the South Sea Company; and the Russian Company, which, after having existed some time, had its charter confirmed in 1566. See INSTITUTION.

COMPASS, MARINERS, the discovery of which is ascribed, by some, to a citizen of Amalphi, in the Neapolitan territory, who lived in the 13th century; and by others it is supposed that the knowledge of this useful instrument was brought from China by the Venetian traveller Marco Paulo. See MAGNETISM.

COMPLEXION is a term which is sometimes applied to the habitude or natural disposition of the body, and is analogous to temperament; and of these temperaments, or complexions, four were described by the older physiological writers,—the sanguine, the phlegmatic, the bilious, and melancholic complexion or temperament; but the term is more usually applied to express the difference of colour which is observed among the inhabitants of different nations; a subject which has excited a great deal of discussion, and much diversity of opinion, among naturalists and physiologists. See MAN, HISTORY OF, under MAMMALIA.

COMPOSTELLA, or ST JAGO DE COMPOSTELLA, the capital of Gallicia in Spain, stands on a hill on the banks of the river Soria; contains a great number of monastic establishments, several public squares, and some magnificent churches, and includes about 12,000 inhabitants, who are engaged in tanning, and in the manufacture of paper, hats, and silk stockings. Compostella is the see of an archbishop, the seat of a university, and is the principal place of residence of the wealthy order of knights of St Jago. This place was famous in the 15th century for the resort of pilgrims from all quarters of Christendom. The number of pilgrims from England in 1428 was nearly 1000, and in 1434 it exceeded 2000.

CONCEPTION, a term applied to that operation of the mind by which it forms a notion of absent objects of perception or of former sensations, and is supposed by some to be analogous to memory, or the recollection of past sensations.

CONCEPTION, one of the principal cities of Chili in South America, stands on a bay of the same name, and contains about 13,000 inhabitants, who have a considerable trade with Peru in hides, tallow, dried beef, and grain, as well as an inland trade with some of the independent tribes in the interior. In 1751 it was completely destroyed by an earthquake.

CONCHOLOGY.

CONCHOLOGY is that department of natural history which treats of testaceous animals, which are included in the third order, *Testacea*, of the class of Vermes, in the Linnæan arrangement, or of those animals which are furnished with a calcareous covering or shell.

The richness and variety of colours, the fine polish, and the beauty and elegance of form exhibited by shells, have always excited admiration, and have procured for them a conspicuous place in the cabinet of the curious collector. But whatever interest the pursuit of this branch of knowledge may have excited in this point of view, and the singular folly and extravagance of mankind in the high price which has been paid for rare and beautiful shells, are not the least striking features in its history. The study of Conchology acquires a higher importance in another view. Many kinds of testaceous animals furnish an excellent and nutritious food, and some tribes supply the table with a delicate luxury. Some shells, as those of mother-of-pearl, afford materials to ingenuity and art, in preparing it for various purposes; and the pearl itself, often the rival of the most precious gems in the estimation of mankind, is the production of testaceous animals; and even the pernicious effects of some species of this tribe of animals demand the attention of man in studying their nature and tracing their history. The snail, in ravaging the garden and the field, marks its progress with the destruction of some of the fairest of the vegetable tribes; and the ship-worm, the dread of the mariner, appears an insignificant instrument in humbling the glory and pride of man, and in demolishing, by its unseen labours, the noblest efforts of his ingenuity and skill.

Conchology has been sometimes confounded with Crustaceology; but the slightest attention will at once point out the great difference which exists between these two classes: Nature has not only well defined them by the composition of the shells, but also by an obvious difference in the construction of the animals which inhabit them. The shells of the *testacea* are composed of carbonate of lime, mixed with a small portion of gelatinous matter; those of the *crustacea* are composed of phosphate of lime along with the animal matter. The shells of the tes-

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tacea are, in general, permanent; and the animal is of a soft and simple nature; while the shells of the crustacea are cast and renewed annually, and the animals are fibrous in their texture, with articulated limbs, covered, as it were, in a coat of mail. Chemists have formed two divisions of the shells of testaceous animals, from the difference of some of them being of a more compact nature than others. *Porcellaneous* shells are of a very compact texture, resembling porcelain with an enamelled surface, and are in general beautifully variegated. To this class belong most of the cones, cowries, and volutes. The second class consists of shells generally covered with a strong epidermis or skin, below which lies the shell, composed of layers, and for the most part of a pearly nature. In this class are many species of the *mytilus*, *haliotis*, and *trochus*.

The porcellaneous shells contain a very small portion of soft animal matter; and those of the second class have a very large proportion.

The study of shells has been by many considered as trifling, and tending to no useful purpose; but its importance must be strikingly evident to all those who make the structure of the earth, and the various changes it has undergone, an object of their attention. For shells are found in abundance in a great variety of rocks and positions, and may be considered as the medals of the ancient world; and, from an accurate acquaintance with their different species, and with the nature of the animals that inhabited them, many curious and important deductions respecting the formation and changes of the crust of the earth may be drawn.

The study of conchology may be traced to great antiquity. The writings of Aristotle and Pliny shew that it was studied in their time; but the first important works on the subject were the productions of Bonanni and Lister. Dr Lister's book may be said to have formed a new æra in conchology, and contributed chiefly to give celebrity to this excellent naturalist. He practised medicine for many years at York, where he cultivated entomology and conchology with much ardour and success. He afterwards settled in London, and was an early and active member of the Royal Society. His *Historia sive Synopsis Methodica Conchyliorum* was published in 1685. It contains very accurate figures of all the shells known in his time, amounting to upwards of 1000. It deserves to be recorded, that they were all drawn and engraved by his two daughters, Susanna and Anne Lister.

Gualtieri's *Index Testarum Conchiliarum*, published at Florence in 1742, is a work of considerable merit; the univalve shells are well drawn, and possess all the characters of the shells; but the bivalves are so indistinct, that they can be of little use in referring to. But the most important work which has hitherto been published on shells, is that of Martine and Chemnitz, published at Nuremberg in 1769. It consists of eleven quarto volumes, and contains figures of above 3,800 shells, all coloured. The first three volumes were drawn up by Martine, and the remaining eight by Chemnitz. The Testacea Britannica of Montagu, is an excellent work, in two quarto volumes, with a supplement published in 1808. The descriptions are correct and full, and are superior to any thing of the kind, with the exception of that valuable descriptive catalogue of the British Testacea drawn up by Dr Maton and the Rev. Mr Rackett, and printed in the eighth volume of the Linnæan Transactions.

History.

The arrangement of shells began at a very early period. Aristotle divided them into univalve, bivalve, and turbinated, and he imposed the name of various genera still retained by modern conchologists; for example, *lepas*, *solen*, *pinna*, *nerita*. But hardly any improvement was made in the arrangement from the time of Aristotle to that of Linnæus. This celebrated naturalist at first established eight genera of shells, namely, *cochlea*, *nautilus*, *cypraea*, *haliotis*, *patella*, *dentalium*, *concha*, and *lepas*. But he afterwards found the necessity of taking some of these genera to pieces, so that in consequence he increased the number of genera to thirty-six: He formed them into three orders, *Multivalve*, *Bivalve*, and *Univalve*.

The first order includes shells consisting of more parts than two. Every part of a shell which is connected by a cartilage, ligament, hinge, or teeth, is called a valve of such shell. The second order includes shells of two valves, generally connected by a cartillage. The third order are shells complete in one piece; this order is subdivided into those with a regular spire, and those without a regular spire.

The first order consists of three genera; Chiton, Lepas, and Pholas.

The second order consists of fourteen genera; Mya, Solen, Tellina, Cardium, Mactra, Donax, Venus, spendylus, chama, Arca, Ostrea, Anomia, Mytilus, and Pinna.

The third order consists of nineteen genera: Argonauta, Nautilus, Conus, Cypraea, Balla, Voluta, Buccinium, Strombus, Murex, Trochus, Turbo, Helix, Nerita, Haliotis, Patella, Dentalium, Teredo, and Sabella.

The last genus is now universally allowed to be unworthy a place among shells, being only coverings made up of extraneous substances; such as sand and broken shells united by a glutinous substance, and may therefore fairly be expunged from the collection of the testaceologist.

Shells are only the habitation of certain vermes, or worms, and are the third order of Linnæus' sixth class of animals, which he terms Mollusca. They come all under ten genera, viz. Limax, Doris, Spio, Amphitrite, Terebella, Nereis, Ascidia, Tethys, Triton, and Sepia.

Limax.—The body is oblong, creeping, with a fleshy kind of shield above, and a longitudinal flat disk beneath: The aperture, or mouth, is placed on the right side, within the shield; it has four feelers, situated above the mouth, and an eye at the tip of each of the largest ones. This genus is generally termed the slug or snail.

Doris.—The body is creeping, oblong, and flat beneath; the mouth placed below on the fore-part; the vent is behind, on the back, and surrounded by a

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fringe; feelers, two and four, seated on the upper part of the body in front, and retractile within their proper receptacles.

Spio.—The body projecting from a tube, joined and furnished with dorsal fibres; peduncles, or feet, rough with bristles, and placed towards the back; feelers two, long and simple; eyes two, oblong.

Amphitrite.—The body projecting from a tube, and annulate; peduncles or feet small and numerous; feelers two, approximate, feathered; with no eyes.

Terebella.—The body is oblong, creeping and naked; often enclosed in a tube, furnished with lateral fasciculi, or tufts, and branchiae; mouth placed before, furnished with lips without teeth, and protruding a clevate proboscis; feelers numerous, ciliate, capillary, seated round the mouth.

Nereis.—The body is long, creeping, with numerous lateral peduncles, or feet on each side; feelers simple, rarely wanting; eyes two or four, rarely none.

Ascidia.—The body is fixed, roundish, and apparently issuing from a sheath; apertures two, generally placed near the upper end, one beneath the other. The animals of this genus are inhabitants of the sea, and adhere by their base to shells, stones, and other submarine substances. The only powers of motion which they possess seem to be that of contracting and dilating themselves alternately, by which means they are enabled to throw out the water which they take in with considerable force.

Tethys.—The body is detached, rather oblong and fleshy, without peduncles; the mouth is furnished with a terminal cylindrical proboscis, under an expanded membrane, or lip; apertures two, on the left side of the neck.

Triton.—The body is oblong; and the mouth with an involute spiral proboscis; tentacula or arms twelve, six on each side, divided nearly to the base; the hind-ones cheliferous.

Sepia.—The body is fleshy, receiving the breast in a sheath, with a tubular aperture at its base; arms eight, beset with numerous warts or suckers, and in most species two pedunculated tentacula; head short; eyes large; mouth resembling a parrot's beak.

The celebrated French naturalist Lamarck has taken quite another view of the *Mollusca*; he divides them into two orders. The first he terms Cephalous, from possessing a head; and the second Acephalous, from their wanting the head. The first of these includes the bivalves, and the second the univalve shells. Each of these he again divides into two sections, the one naked or without shells, and the other covered, or nearly so, with a testaceous habitation or shell.

The following is an outline of his arrangement of Mollusca, shewing his genera, and that of Linnæus, with a reference to one of the Linnæan species as an illustration.

MOLLUSCA, with Heads.

Naked. Those which swim at liberty.

Lamarck's Genera.	Linnean Genera.	Linnean Species.
1. Sepia	Sepia	officinalis
2. Loligo	—	Loligo
3. Octopus	—	Octopus
4. Lernaea	Lernaea	
5. Pterotrachea	Petrotrachea	
6. Clio	Clio	
Those which creep on the belly.		
7. Laplicia	Laplicia	
8. Dolabella		
9. Bullaea	Bulla	Aperta
10. Tethis	Tethys	
11. Limax	Limax	
12. Sigaretus	Helix	Haliotoidea
13. Onchidium	Onchidium	
14. Tritonia	Tritonia	
15. Doris	Doris	
16. Phyllidea		
17. Chiton	Chiton	
Covered with Shell. One-celled, and not spiral, but covering the back of the animal.		
18. Patella	Patella	testudinaria
19. Fissurella	—	Graeca
20. Emarginula	—	Fissura
21. Concholepas		
22. Crepidula	—	porcellana
23. Calyptraea	—	equestris
One-celled, spiral, inclosing the animal, with a hollow at the base of the aperture.		
24. Conus	Conus	
25. Cypræa	Cypræa	
26. Ovula	Bulla	Ovum
27. Terebellum	—	Terebellum
28. Oliva	Voluta	porphyria
29. Ancilla	—	Oliva
30. Voluta	—	musica
31. Mitra	—	episcopalis
32. Columbella	—	mercatoria
33. Marginella	—	glabella
34. Camellaria	—	cancellata
35. Nassa	Buccinum	Arcularia
36. Purpura	—	Persicum
37. Buccinum	—	undatum
38. Eburna	—	glabratum
39. Tenebra	—	maculatum
40. Dolium	—	Dolium
41. Harpa	—	Harpa
42. Cassis	—	cornutum
43. Strombus	Strombus	pugilis
44. Pterocera	—	Lambis
45. Rostellaria	—	fusus
46. Murex	Murex	Haustellum
47. Fusus	—	Colus
48. Pyrula	Balla	Ficus
49. Fasciolarea	Murex	Tulipa
50. Turbinellus	Voluta	Pyrum
51. Pleurotoma	Murex	Babylonius
52. Clavatula		
53. Cerithium	Murex	luco.
One-celled, spiral, inclosing the animal, without any hollow at the base of the aperture.		
54. Trochus	Trochus	niloticus
55. Solarium	—	perspectivus
56. Turbo	Turbo	marmoratus
57. Monodonta	Trochus	Labio
58. Cyclostoma	Turbo	Delphinus
59. Scalaria	—	scalaris
60. Pupa	—	Uva
61. Turritella	—	Terebra
62. Ianthina	Helix	Ianthina
63. Bulla	Bulla	Ampulla
64. Bulimus	Helix	oblonga

Arrangement.

65. Achatina	Bulla	achatina
66. Lymnaea	Helix	stagnalis
67. Melania	—	amarula
68. Pyramidella	Trochus	dolobratus
69. Auricula	Voluta	Auris Midae
70. Volvaria	Bulla	cylindrica
71. Ampullaria	Helix	ampullacea
72. Planorbis	—	Cornu Arietis
73. Helix	—	pomatia
74. Helicina		
75. Nerita	Nerita	exuvia
76. Natica	—	Canrina
77. Testacella	—	
78. Stomatia	Haliotis	imperforata
79. Haliotis	—	tuberculata
80. Vermicularia	Serpula	lumbricalis
81. Siliquaria	—	Anguina
82. Penicillus	—	Penis
83. Carinaria	Argonauta	vitrea
84. Argonauta	—	Argo

Many cells, inclosing or covering the animals.

85. Nautilus	Nautilus	Pompilius
86. Orbulites		
87. Ammonites	Nautilus	Cornu Ammonis
88. Planulites		
89. Nummulites		
90. Spirula	Nautilus	spirula
91. Turrilites		
92. Bacculites		
93. Orthocera	Nautilus	raphanus
94. Hippurites		
95. Belemnites	Nautilus	belemnites

Headless Mollusca.

Naked.

96. Ascidia	Ascidia	
97. Salpa	Salpa	
98. Mammaria	Mammaria	

Covered with shell.

Two valves equal, with or without accessory ones.

99. Pinna	Pinna	rudis
100. Mytilus	Mytilus	edulis
101. Modiola	—	Modiolis
102. Anodonta	—	anatin
103. Unio	Mya	Pictorum
104. Nucula	Arca	Nucleus
105. Pectunculus	—	Pectunculus
106. Arca	—	Noae
107. Cucullaca	—	cucullata
108. Trigonia		
109. Tridacna	Chama	Gigas
110. Hippopus	—	Hippopus
111. Cardita	—	calyculula
112. Isocardia	—	Cor
113. Cardium	Cardium	costatum
114. Crassatella		
115. Paphia	Venus	divaricata
116. Lutraria	Mactra	lutraria
117. Mactra	—	Stultorum
118. Petricola	Donax	Irus
119. Donax	—	rugosus
120. Meretrix	Venus	meretrix
121. Venus	—	verrucosa
122. Venericardia	—	imbricata
123. Cyclas	Tellina	cornea
124. Lucina	—	divaricata
125. Tellina	—	radiata
126. Capsa	Venus	deflorata
127. Sanguinolaria	Solen	sanguinolentus
128. Solen	—	Vagina
129. Glycimeris	Mya	Siliqua
130. Mya	—	Truncata
131. Pholas	Pholas	costata

Bivalves inclosed in a tube, valves unequal.

132. Teredo	Teredo	navalis
133. Fistularia	—	Clava

Two unequal valves, with or without a hinge.

134. Acardo	Patella	Umbello
135. Radiolites		
136. Chama	Chama	Lazarus
137. Spondylus	Spondylus	Gaederopus
138. Plicatula	—	plicatus
139. Ostrea	Ostrea	edulis
140. Vulsella	Mya	Vulsella
141. Malleus	Ostrea	Malleus
142. Avicula	Mytilus	Hirundo
143. Perna	Ostrea	Ephippium
144. Placuna	Anomia	Placenta
145. Pecten	Ostrea	maxima
146. Lima	—	Lima
147. Pedum	—	spondyloides
148. Pandora	Tellina	inequivalvis
149. Corbula		
150. Anomia	Anomia	Ephippium
151. Crania	—	craniolaris
152. Terebratula	—	Terebratula
153. Calceola	—	Sandalium
154. Hyalaea	—	tridentata
155. Orbicula	Patella	anomala
156. Lingula	—	Unguis

More than two valves, unequal.

157. Anatifa	Lepas	anatifera
158. Balanus	—	Tintinnabulum
159. Coronula	—	Diadema

Nothing is of greater importance to the student than a correct knowledge of the different parts of shells; for it is only by a distinct idea of such parts that we can become acquainted with a shell by description. We shall begin according to the Linnæan order, by first describing the parts of multivalve shells.

Parts of Multivalve Shells.

Operculum, or lid, is four valves placed on the top of the opening of the lepas; these are affixed to the body of the shell by ligaments, and can be moved at pleasure by the animal, and between the seams of the valves the animal protrudes its feelers. This operculum is different from that of univalves, which will be described in its place. Plate 53. Fig. 1. *m.*

Base is that part of the shell by which the lepas are fixed to other bodies, such as rocks, wood, or other extraneous bodies. Plate 53. Fig. 1. *q.*

Apex, the opposite extremity to the *base* of the shell. The top of the operculum, in Plate 53. Fig. 1.

Ligament, A membranaceous or tendinous substance, by which the valves, or parts of the shell, are connected. Some of the multivalve shells are connected by the parts of one valve locking into those of another. Plate 53. Fig. 2. L.

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Ridges, the higher parts of some of the balani, sometimes longitudinal, and in others transverse. They are well exemplified in lepas balanus.

Peduncle, the stem on which the second division of the lepas is seated. It is attached to wood and other extraneous bodies by the base of the pedicle, or extremity opposite to that on which the shell is fixed. It is a membranaceous substance, and contains a liquid evidently connected in an intimate degree with the existence of the animal. Plate 53. Fig. 2. x.

Feelers are the crenated arms which protrude themselves from the operculum of the first order of the lepas, as also from the back of the second division, called the anatiferous shells. Plate 53. Fig. 2. *Z.*

Parts of Bivalve Shells.

Bivalve shells consist of two parts or valves, connected by a cartilage and hinge; for the most part containing teeth, those of the one valve fitting into a socket or cavity in the opposite valve.

Some bivalves have both valves formed alike, and others are very dissimilar, one being smooth and the other knotty, rugose, or striated, one flat and the other convex, and in many instances the one larger than the other.

The shells of the mya, solen, tellina, cardium, mactra, donax, and Venus, are for the most part equivalve: while those of the spondylus, chama, ostrea, anomia, and pinna, are in general dissimilar.

Equilateral shells are those which have valves, both sides of which are alike, as in the division of the ostrea called scallops, or pectens, by the French conchologists, the arca glycimeris, and pilosa of Linnæus, &c. Plate 53. Fig. 14.

Inequilateral shells are those whose sides are unequal; and are exemplified in most species of mya, donax, &c. Plate 53. Fig. 11. 13. 16. &c.

Summit is applied to the most elevated part of the shell, when placed on its base, or those protuberant parts of almost all bivalves, which extend beyond the hinge of the shells, which are termed the beaks. Plate 53. Fig. 6. *a.*

Base is the opposite extremity of the summit. Plate 53. Fig. 6. *b.*

Sides, the right and left sides, or lateral parts of the valves. Plate 53. Fig. 10. *c.*

Anterior slope, is that part of the shell in which the ligament is situated. In viewing the anterior slope in front, the beaks of the shell retire from the observer. Plate 53. Fig. 6. *d.*

Posterior slope, that part immediately opposite the anterior slope; in viewing it in front, the beaks point towards the observer. Plate 53. Fig. 6. *e.*

Disk, the convex centre, or the highest part of a valve when laid down with the inside undermost. Plate 53. Fig. 6. *f.*

Inside, the concave part of a valve. Plate 53. Figure 7. *g.*

Cicatrix, or *tongue*, is the impression left on the inside of the valves by which the animal was attached. This part differs very materially in shape, depending upon the particular form of the adhering muscles of the animal which inhabits the shell, and is to be found ovate, round, lunate, &c. This part is often of great use in distinguishing a species, possessing frequently very obvious characters. Some species have only one cicatrix, as in the edible oyster and muscle, while others have two, and a very few species three in each valve. Plate 53. Fig. 10. *h.*

Lunule, the lunated depressions situated below the beaks, sometimes on the anterior or posterior slopes, and often on both, as in the Venus tribe. Plate 53. Fig. 6. *i.*

Ligament perforation, the circular aperture, or perforation, through which the testaceous plug passes, by which the animals of the anomia affix themselves to other bodies. In most species it is in the flat, and in a few instances in the convex valve. The shape, or size, of this perforation is not at all to be attended to in the description of a species, as it is found to differ so widely in the same species that it never can be relied on as a distinguishing mark. Plate 54. Fig. 3. *k.*

Hinge is the point of union between the valves, and on which they move. In this are placed the teeth, which are small prominent knobs, fitting into corresponding sockets in the opposite valve. It is upon the number, structure, and situation of the teeth, which is universally a prominent character in bivalves, that the generic and specific characters of theshells are formed. The variety of structure observable in the teeth of bivalves is truly surprising; some are numerous, with a serrated appearance; others are single, solid, and thick, sometimes spatuliform, laminiform, subulate, and cleft, and often double; they may be divided into the following order of hinges: 1st, *Inarticulate*, or those hinges only furnished with callosities, or having no visible teeth; 2d, *Articulate*, when they have only a small number of teeth; 3d, *Multiarticulate*, when the teeth are numerous, as in the arca genus. Plate 54. Fig. 5. *l.*

Primary teeth are those teeth in general about the centre of the hinge, and are in general larger then the others, and not unfrequently elevated above the surface of the shell. Plate 54. Fig. 5. *n.*

Lateral teeth are those teeth which diverge from the umbo, or are placed remote from it, and often double or cleft, or sometimes long and flat. Plate 53. Fig. 15. *o.*

Double teeth, Plate 53. Fig. 10. *y.*

Recurved teeth, those teeth which bend outwards, as in the spondylus. Plate 54. Fig. 2. P.

Incurved teeth are those which are bent round or inwards, as in the solen siliqua, &c.

Middle teeth, Plate 53. Fig. 11. R.

Numerous teeth are those small teeth which constitute the arca genus, often set in a row, and at other times formed in an angular shape. Plate 53. Fig. 16. S.

Cavity of the hinge, the hollow depression in which the ligament of the ostrea is situated, which is in general of a triangular form. Plate 53. Fig. 14. t.

Ligament of the hinge, or cartilage, is that flexible fibrous substance by which all bivalves are united, and by which the hinges are kept in their proper places, and situated under the beaks of the shell. Plate 53. Fig. 9. v.

Beak is the extreme point of the summit of bivalves, and which in many species turns spirally down-

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wards, or to the one side, and from this circumstance is seldom the highest part of the shell. Plate 53. Figs. 10. and 12. y, y.

Seam, the line of separation when the valves of any shell are closed.

Umbo, that part situated immediately under the beak. Plate 53. Figs. 12. and 13. W, W.

Ears, the processes on each side of the beak, in all that division of ostrea termed scallops; in some species the ears are of the same size, in others the one is much inferior to the other; indeed, some are scarcely observable on one side. Plate 53. Fig. 14. A, B.

Superior ear, Plate 53. Fig. 14. A.

Inferior ear, Plate 53. Fig. 14. B.

Margin or limb, the extreme edge of the whole shell, or the whole circumference of a valve when laid flat down on one valve. Plate 53. Fig. 10. C, C.

Crenulated margin, the fine saw-like edge of most of the cardium (cockle) and donax tribes. Plate 53. Fig. 11. D.

Ribs, the higher parts of slopes; sometimes longitudinal, and sometimes transverse. Plate 53. Fig. 13. E.

Striæ, are fine thread-like lines, generally on the exterior surface of shells, and at times in the inside; it is sometimes both longitudinal and transverse. When the striæ of shells appear indistinct, and as if worn out, it is termed *obsolete striæ*. When striæ cross or intersect each other at acute angles, it is termed *decussated*.

Right valve is that valve when viewed with the inside uppermost, and the anterior slope pointing to the right hand. Plate 53. Figs. 12. and 13. F.

Left valve, the opposite of the above, or, viewed in the same way, the anterior slope points to the left hand. Plate 53. Figs. 12. and 13. G, G.

Length of the shell is always taken from the ligament or the beak to the opposite margin. For example, the common muscle is longer than it is broad, and the solen siliqua, or common razor-shell, is broader than it is long. Plate 53. Figs. 8. and 11. H, H. and Plate 54. Fig. 1. H, H.

Breadth is always measured from the most extreme edge of the anterior and posterior sides of the shell, being in a contrary direction from its length. Plate 53. Figs. 7. and 8. I, I.

Byssus or beard, is an appendage composed of filaments of a silky texture, by which some of the bivalves, such as the mytilus and pinna, fasten themselves to rocks and other extraneous substances. Plate 54. Fig. 4. K.

Parts of Univalve Shells.

The shells of this order are considerably more numerous than of the two preceding, not only in the genera but also in the species; there is more difficulty attending the discrimination of species; the characters are not so obvious as in bivalves, for they possess no character equivalent to the teeth as distinguishing marks; and besides, the species run into each other so closely in some instances, that the greatest attention is requisite to separate them, and there are often several varieties of the same shell.

In the examination of shells of this order, the general contour, or outline of the whole shell, is the first particular to be attended to. As this leads to those distinctions necessary in the definition of simple, spiral, or turbinated shells, or more strictly, according to the Linnæan method of discrimination, univalves with a regular spire, and those without a regular spire. The genera of this order are formed principally from the shape of the aperture, together with the general contour of the shell; whether the spire be lengthened or depressed, being with or without a canal, the length of the beak, and its direction, together with the particular form of the outer lip, &c. The colour of shells only serves as a specific distinction, and cannot in all cases be depended upon, though it is often an unvarying mark in some species; as also the particular way in which the spots or markings are disposed.

Apex, the summit or highest tip of the spire. Plate 54. Fig. 11. O. and Plate 55. Fig. 13. O.

Base, is the opposite extremity from the apex. In shells with a beak or rostrum, it is the tip of such beak. In the patella the base is understood to be the extreme edges of the shell when laid on its mouth, in opposition to the vertex or highest point. The base of the dentalium and teredo is understood to be the wider end of the shell. Plate 54. Fig. 11. P. and Plate 55. Fig. 13. P.

Body of the shell is the first or lower whorl, or that in which the aperture is situated; which is in general larger than the others. Plate 54. Fig. 11. Q.

Front of the shell is that side in which the aperture is situated.

Back, is that side of the shell directly opposite to the aperture, or when the shell is viewed with the aperture turned from the observer.

Venter or belly, is the most prominent part of the lower whorl or body of the shell, situated in the vicinity of the outer lip, and formed by the convexity of the aperture. It is in general only made use of in describing shells whose body is large in proportion to the size of the spire. Plate 55. Fig. 5. R.

Sides, the extreme edges of the shell, when viewed either in front or from the back. Plate 54. Fig. 11. U.

Aperture, or mouth, is that part of the lower whorl or body by which the animal protrudes itself. This in some species is either entirely open, or closed by the operculum or lid when the animal withdraws to the inner chambers. The aperture is one of the principal generic distinctions of univalve shells, and differs materially in shape, some being round, subrotund, or ovate; others semilunar or angular; some with a canal or gutter, and others without it. In some of the genera it extends the whole length of the shell, as in the cypræa, and some of the cones with depressed spires. Plate 55. Fig. 5. Y.

Canal, or *gutter*, is an elongation of the aperture or both lips of the shell, at the lower part of the body, generally in a direct line with the tip of the spire, situated in the beak, in which it forms a concave gutter or channel, commencing with the aperture, and terminating at the point of the beak. Some species are furnished with two canals; one situated at the junction of the outer lip and the body, as in

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the murex lampas, &c. Plate 55. Figs. 6. and 14. W, W.

Beak, or rostrum, is that lengthened process which extends from the base of the shell, or lower part of the body, in which the canal is situated. It commences a little higher up on the outside than the canal, which is in general very distinctly marked by the line of the aperture. This process is not so conspicuous in some of the species of voluta, but is more marked in the genera murex and strombus; in the murex haustellum and colus, it is a prominent feature. Plate 55. Fig. 14. X.

Pillar, or columella, is that process which runs through the centre of, and is the support of the spire of most of the spiral univalve shells; it commences near the base, and terminates at the apex. Plate 54. Fig. 11. Y, Y.

Pillar lip, is a continuation of the enamelled substance with which the aperture is internally lined, expanded or spread over the columella, or that part of the body close to the aperture. Plate 55. Fig. 6. Z.

Outer lip is the edge or termination of the body of the shell, on the left margin of the aperture in dextral or right-handed shells; it is also lined with the enamel of the aperture. Plate 55. Figs. 3. and 6. a, a.

Plaited columella, is exemplified in the shells of volutes, most of which have plaits or folds on the pillar. Plate 55. Fig. 6. b.

Operculum or lid, cannot properly be considered a part of the shell, being only an appendage to many of the turbinated or spiral shells affixed to the animal, sometimes testaceous, and sometimes only a cartilaginous substance. It is only a door or lid to protect the animal from the intrusion of its enemies, when it retires within its dwelling. The operculum varies much in shape, being in general calculated to fill the opening, and admirably adapted for that purpose.

The operculum is generally attached to the foot of the animal. It is in the power of every one who lives by the shore to make himself acquainted with the situation of the operculum of univalves, as this process is attached to several shells, very abundant on most shores, viz. the turbo littoreus, (the periwinkle,) and rudis, the buccinum undatum, (or common whelk,) and the nerita glaucina; these operculi are all of the cartilaginous nature. Plate 55. Fig. 9. the operculum of buccinum undatum.

Spire, is all the volutions of the shell, with the exception of the lower one, which is termed the body. This is a prominent feature in univalve shells, as upon its being acute or depressed, the whorls being close to each other or separated by a deep suture or groove, depends much of the specific definition. Adanson in his 'Natural History of Senegal,' says, 'that the external character of the spire varies according to the plane they turn upon, which is either horizontal, cylindrical, conic, or ovoid. At the same time, he admits there are a great many intermediate forms, which cannot properly be defined.

Young shells in general have fewer volutions or turnings than those full grown; therefore the description of the number of wreaths cannot at all times be depended upon; a full grown shell may, in general, be known from the outer lip, which has mostly an unfinished appearance in young shells. Indeed, in all the fresh water and land shells it is a distinct criterion, as they are never complete in the form of the outer lip till full grown. Plate 55. Fig. 3. d.

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Whorl is one of the wreaths or volutions of the spire. Plate 55. Figs. 2 and 4. *e e*.

Depressed spire is when the spire is very flat, as in the helix planorbis, &c. Plate 54. Fig. 15. and 16.

Involuted spire, those shells which have the spire concealed within the body of the shell, as in the nautilus, cypraea, and some species of bulla. Plate 54. Figs. 12. and 13. and Plate 55. Fig. 1.

Suture of the spire, is a fine spiral line, which separates the whorls of the spire from each other, it is sometimes crenulated, undated, or sulcated, and not unfrequently elevated or projecting. Plate 54. Fig. 11. i. and Plate 55. Fig. 6. i.

Reversed, or heterostrophe spire, is when the spire turns contrary to the usual manner, or like a sinistral or left-handed screw; or as a further illustration, they have their aperture placed on the right side when viewed in front, with the spire uppermost and standing on their base. To an unexperienced observer, it is often a difficult matter to determine, whether a flat or depressed shell is dextral or sinistral. Plate 54. Figs. 9. and 17.

In some of the more depressed species of *helix* and *nautilus*, great attention is required, in order to determine which is really the upper side of the shell, for it is on that side the spiral turns are to be taken from the centre to the apex; and in most instances this is to be determined by the oblique direction of the aperture to the under part, where the lip rarely extends so far as on the upper part. In fixed shells, such as *serpula*, there is no difficulty, as the side which is *sessile*, or on which the shell is seated or fixed, must be considered as the base. Thus, in the *serpula lucida*, the fixed part is sometimes very small, and the mouth protends spirally upwards, in a contrary direction to the sun, and therefore must be considered a reversed or *heterostrophe* shell, the same as if the volutions nearest the mouth had turned laterally upon the centre or fixed ones. This shell, indeed, is most frequently found with regular lateral volutions, and though subject to great variety with respect to contortions, it invariably turns the aperture one way.

In some species of *nautilus*, however, there can be no rule to ascertain whether it is dextral or sinistral; for when the aperture is exactly lateral, the lip collapses the body equally, and the sides of the shell are similar, as in the *nautilus calcar*, therefore it cannot be defined.

Chambers are those cavities of certain shells formed by partitions, in some nautili at regular intervals, and in some species of *serpula* at irregular distances. Plate 54. Fig. 7. l.

The chambers of the nautili have always an opening or communication with each other by means of a small perforation or siphuncle; whereas those of the serpula have no such communication, being invariably closed. Several species of patellae have laminiform processes, termed chambers; these in general lie

Terms.

horizontally, and are quite open at one end, as in the *patella testudinaria*, Plate 54. Fig. 6. 1.---or are subspiral, as in *patella equestris*.

Umbilicus is in general a circular perforation in the base of the lower whorl or body, in many univalve shells. This is common in the genus *trochus*; and in some species it runs from the base to the apex, being wider at the base, and gradually tapering towards the apex. Plate 54. Fig. 8. m.

Sub-umbilicus, is when the umbilicus is in a great measure closed by a thin process, or when it is only a slight indentation. Sub-umbilicated shells are most commonly to be met with among species of murex buccinum, and a few of turbo. Plate 55. Fig. 2. A.

Shells destitute of an umbilicus are termed *imperforate*.

Siphunculus is that small round perforation which forms a communication through the walls of the chambers of the nautili, and is continued through the whole spire. Plate 54. Fig. 7. n.

Varices are transverse sutures, which cross the wreaths of the shell, in some species of buccinum and murex. Plate 55. Fig. 14. f.

Ribs are longitudinal and transverse protuberances, in many of the univalve shells. Plate 55. Fig. 14. *o*.

Teeth of univalve shells, according to Colonel Montagu's definition, are not properly denticles or teeth, but are fine *laminae*, or ridges running spirally backwards in a parallel direction to each other. In many of the foreign land helices, however, they are very conspicuous and prominent, and are also very distinctly marked in the British land species of *turbo*, and in *turbo nigricans, dentatus, laminatus*, &c. Plate 55. Fig. 11. Q.

Epidermis is a skin or cuticle with which the exterior surface of many of the shells of all the orders are covered, and is produced by marine, land, and fresh-water species. It seems destined by nature to protect the surface of their shells from being injured. It is of a membranaceous substance, and somewhat similar to the periosteum which covers the bones of animals. This substance is the production of the animal inhabiting the shell; it is uniformly observed in some species and not at all in others. Shells with a rugged or uneven surface have in general an epidermis. In some it is strong, laminated, velvety, fibrous, and rough, often beset with strong hairs and bristles; in others it is very thin, smooth, shining, and pellucid, and admits the colours of the shell to shine through it. In some species it is so dusky, that it entirely obscures the beautiful colouring of the shell below. But we would by no means advise it to be removed from all the specimens, it being preferable to have at least one specimen in its natural state.

In our view of genera, we mean to adhere strictly to the arrangement of Linnæus, for two reasons; first, because it is better known in this country, and, secondly, because it is more simple than that of Lamark, and is, in our opinion, adapted to embrace every species by the formation of new sections to some of the genera. At the same time, we shall insert in each genus the new genera formed by Lamarck from such genera, placing them with those to which they seem nearest allied. The arrangement of Linnæus is entirely artificial, and unconnected with the animal inhabitant. That of Lamarck is the two united, that is, both on natural and artificial principles. A natural arrangement would no doubt be preferable to an artificial one; but our present limited knowledge of the animals inhabiting the shells prevents the possibility of such an arrangement. We also object to the Lamarckean arrangement, on the score of its being too comprehensive; we can see no end to the formation of genera; and it might on the same principles be extended even far beyond the limits of Lamarck himself.

Genera.

Since the time of Linnæus, several new species have been discovered, which might with much propriety be formed into new genera, as they possess characters very different from any of the Linnæan genera; but we can see no room for a total overthrow of the simple and beautiful arrangement of that great naturalist.

We shall therefore take a view of the two systems as we proceed in our definitions of the Linnæan genera; and at the same time, under each genus, introduce such species as are either curious in their natural history, or in themselves rare.

Illustration of the Genera.

Order I. Multivalve Shells.

The *animals* of all the testacea are soft, of a simple structure, and are covered with a calcareous habitation or shell.

Gen. 1. Chiton. *Coat of Mail.*

Generic character.—Animal inhabiting the shell a doris; shell consisting of several segments or valves, placed transversely on the back of the animal, and lying upon each other at their anterior edge.

A single valve of chiton maculatus is represented, Plate 53. Fig. 5.

Lamarck has removed the genus chiton into the naked cephalous mollusca. The animals of this genus bear a strong resemblance to those inhabiting the patellae; and are placed by Cuvier in his order Cyclobranchia. They adhere to rocks and stones, and are most frequently to be found under stones in pools of water, between high and low water mark.

The animals of the chiton have the powers of contraction and extension; they can stretch themselves at full length, or roll up like a ball; and in this state have every appearance of a wood louse. The valves move on each other like the joints on the tail of a lobster. Poli, in his work on the shells of the two Sicilies, has formed a new genus of this animal, under the name of laphyrus. The following is its generic character: Body oval, flat beneath, without eyes or tentacula; with an oval foot, head surmounted by a crest, with a wrinkled mouth beneath; the exterior air vessels are separate, pinnated, and placed round the body between the mouth and the foot.

C. lineatus.—Shell with eight smooth streaked valves, and a broad coriaceous margin. The colour is of a bright chesnut, with an interrupted white band running along the back; and undulating white lines, edged beneath with black, pass diagonally across the marginal triangles, and concentrically on the extreme valves. Length $1\frac{1}{2}$ inch; breadth about $\frac{6}{8}$ths of an inch. Plate 53. fig. 4. Wood's *Conchology*, Pl. 15. *t*. 2. fig. 4. and 5.

Multivalves.

C. marginatus.—Shell with eight carinated valves, and a serrated reflected margin. This shell, upon being viewed through a strong lens, appears like shagreen; and the colour is dingy brown, reddish, or grey.

This shell is frequently to be met with on the British coasts, adhering to rocks, and under stones near high-water mark. At first sight it might be mistaken for an oniscus. Length half an inch, breadth about a quarter of an inch. Wood's *Conch.*, p. 21. *t.* 3. fig. 4.

The number of species discovered of this genus is forty, of which seven inhabit the British seas.

Gen. 2. Lepas. *Barnacle.*

Gen. char.—Animal a triton; shell affixed at the base, and consisting of many unequal erect valves.

L. Tintinnabulum.— Shell purplish, with the valves irregularly and strongly ribbed longitudinally, and the interstices delicately striated transversely. Plate 53. Fig. 1. Donovan's *British shells*, v. *t.* 148.

This shell inhabits the West Indies, the East Indies, and Britain, affixing itself to extraneous bodies, and varies in size from a quarter of an inch to two and a half inches in length, and is also subject to great variety in point of form.

L. anatifera.—Shell compressed, with five obsoletely striated valves, the lower valves somewhat triangular, the superior ones long, and tapering to an obtuse point. The valves are connected by a cartilage of an orange colour, and affixed to a peduncle from half an inch to a foot long, of a scarlet or orange colour. Plate 53. Fig. 2.

This shell is generally affixed to pieces of rotten wood, the bottoms of vessels, &c., and is an inhabitant of all seas. Donovan's *British shells*, v. I. *t.* 7.

A superstitious notion has prevailed that the bernacle goose was produced from this shell; and even to this day, in many parts of the Western Highlands of Scotland, the lower class of people firmly believe in this ridiculous transformation. Gerard gives a curious account of this transformation in the following words: "There is found in the north parts of Scotland, and in the islands adjacent called Orchades, certain trees, whereon do grow certain shells tending to russet, wherein are contained little living creatures, which shells in time of maturitie do open, and out of them grow those little living things which falling into the water do become fowles, which we call barnakles, in the north of England brant geese, and in Lancashire tree geese; but the other that do fall upon the land perish and come to nothing. Thus much for the writings of others, and also from the mouths of people of those parts, which may very well accord with truth."

"But what our eyes have seene, and hands have touched, we shall declare. There is a small island in Lancashire, called the pile of Foulders, wherein are found broken pieces of old and bruised ships, some whereof have been cast thither by shipwracke, and also the trunks and bodies with the branches of old and rotten trees cast up there likewise, whereon is found a certain spume or froth, that in time breedeth into certain shells, in shape like those of the muskle, but sharper pointed and of a whitish colour, wherein is contained a thing in form like a lace of silke finely woven as it were together, of a whitish colour, one end whereof is fastened into the inside of the shell, even as the fish of oisters and muskles are; the other end is made fast into the belly of a rude mass or lumpe, which in time commeth to the shape and forme of a bird: when it is perfectly formed, the shell gapeth open, and the first thing that appeareth is the foresaid lace or string, next come the legs of the bird, and hanging out, and as it groweth greater it openeth the shell by degrees, till at length it is all come forth, and hangeth out by the bill; in short space after it cometh to full maturitie, and falleth into the sea where it gathereth feathers and groweth to a fowl bigger than a mallard, and lesser than a goose, having blacke legs, bill, or beake, and feathers black and white, spotted in such a manner as a magpie, called in some places a pie-annet, which the people of Lancashire call by no other name than a tree-goose; which place aforesaid, and those parts adjoining, do so much abound therewith, that one of the best is bought for *three-pence*. For the truth hereof, if any doubt, let them repaire unto me, and I shall satisfie them by the testimonie of good witnesses." Gerard's *Herball*, p. 1587.

Lamarck, in his arrangement, has altogether suppressed the Linnæan generic name of lepas, having formed four new genera from it, with the following characters:

Balanus—a conical multivalve shell, fixed by its base, and composed of six articulated valves; the opening being closed by an operculum, formed of four valves. See *Lepas Balanus*, Donovan's *Br. Shells*, I. *t.* 30. fig. 1.

Coronula—a regular subrotund, or subconical shell, divided into twelve areae, with an opening both in the top and base; that in the top being closed by a four-valved operculum. See *Lepas Diadema*, Wood's *Conch.* p. 27. *t.* 7. fig. 3.

Anatifa—a cuneiform multivalve shell, composed of several unequal valves, five or more, united together at the extremity of a cartilaginous tube, or peduncle, fixed at the base; the opening without an operculum. *Lepas Anatifera*, Plate 53. Fig. 2.

Tubicinella,—a tubular, univalve, not spiral, narrowing towards the base, truncated at each end; The aperture round, with a four-valved operculum. See *L. Tracheaeformis*, Wood's *Conch.* p. 4.* fig. 1, 2, 3.

This remarkable species inhabits the back of the South-sea whale, burying itself in the skin and fat. Dufresne, in a memoir which is a continuation of that of Lamarck, informs us that the animal is furnished with a collar, lightly striated, which secretes the testaceous matter which forms the rings on the shell.

The modern Linnæans have subdivided the lepas into two subdivisions: A. shells sessile, comprehending all those of the acorn-shells; and have formed the following sections,---* with the base solid;** with radiated cells at the base; *** porous at the base; **** with a cup-like appendage at the base; ***** tubular and truncated at both ends. B. shells seated on a fleshy peduncle, comprehending the barnacle shells, with the following sections: * with more than five valves, and a wreath of smaller ones round the base; ** with five contiguous valves; *** with minute distant valves, placed on a fleshy extension of the peduncle. The number of well ascertained species is 45, and 17 of them have been found in the British seas.

Different individuals of the same species are subject to great variety of form, owing to the particular situations on which they grow. As soon as the eggs are excluded from the parent shell, they adhere to something in their immediate neighbourhood. When they are deposited in groups, as they grow they are constrained for want of room, which makes them mis-shapen and irregular; and when very close together they become elongated, the whole shell shooting to the length.

Lamarck now considers the lepas of Linné as constituting a particular division of the crustaceous animals; and he has placed them in his new class under the name of Cirrhipedes.

Gen. 3. Pholas. *Borer, or Pidock.*

Gen. char.---Animal an ascidia; shell bivalve, divaricate, with several lesser valves differently shaped; accessory ones at the hinge; hinges recurved, united by a cartilage; in the inside, beneath the hinge, is an incurved tooth.

P. crispata,---Shell oval, rather obtuse, and marked with waved angular striae on one side; hinge with a curved tooth. Shell from one to two inches long, and sometimes nearly three inches broad; gibbous, opake, and of a brownish white colour. This species may be readily distinguished by its having a longitudinal furrow in the middle, on one side of which the shell is covered with muriated striae, and the other side is only transversely wrinkled. This shell is not uncommon in many parts of Europe and Great Britain, burrowed in rocks and stones, but most frequently to be met with in shale. Specimens, of a large size, are to be met with at Blackness-castle, in the blue clay. Donovan's *British Shells*, II. *t.* 62.

P. candida,---Shell oblong, covered with decussated prickly striae; about three quarters of an inch long, and two inches broad, white, brittle, and rounded at both ends; the decussated striae extend over the whole surface of the shell, but are stronger and more prickly at the broader end. Inhabits Europe, America, and is not unfrequent in Great Britain. Plate 53. Fig. 3.

The pholas genus are found burrowed in hard clay, limestone, and sometimes sandstone and wood, below high-water mark, which they perforate in their young state, and as they increase in size they enlarge their habitation. The faculty possessed by the pholas of penetrating hard substances, has long excited the attention of philosophers, though they have hitherto been unable to account for it in a satisfactory manner. Reaumur is of opinion that they work their way into limestone and other hard substances by the continual rotation of their valves acting like a rasp. But from some species, particularly the P. orientalis, being smooth, this conjecture is quite unsatisfactory. The pillars of the temple of Serapis, at Puteoli, are much perforated with the pholades. Dr Bohadsch, when visiting that place, noticed these pillars, and concluded that they must have penetrated them while they were covered by the influx of the sea, which immediately succeeded the destruction of the city by an earthquake; for he very justly observes, the workmen must have rejected stones so much perforated as they are by pholades.

On the coasts of Normandy the pholas is considered a great delicacy, and is dressed with crumbs of bread and herbs, and well seasoned. It is also pickled with vinegar.

The phosphorescent properties of this animal are very remarkable; it contains a liquor which shines with uncommon splendour in the dark, and illuminates whatever it touches. It is also said to illuminate the mouth of the person who eats it; and it is remarkable that, contrary to the nature of other fish, which give light when they tend to putrescence, this is more luminous the fresher it is; and when dried, its light will revive on being moistened either with salt water or fresh; brandy, however, immediately extinguishes it.

It would be difficult to state the true cause of this remarkable property in the animal of the pholas; but it seems to proceed from something of a phosphorescent nature.

This genus is so perfect, that it has bidden defiance to any alteration, excepting that Lamarck has considered the accessory valves as of secondary importance, and has united it with the bivalves.

Only twelve species of this genus have been discovered, five of which have been ascertained as British.

Order II. Bivalve Shells.

Gen. 4. Mya. *Gaper.*

Gen. char.—Animal an ascidia; shell bivalve, generally gaping at one end; hinge with a broad, thick, strong patulous tooth; seldom more than one, and not inserted in the opposite valve.

The mya is in four subdivisions: * hinge with one or two rounded teeth, not inserted into the opposite valve; ** hinge callous, without teeth; *** hinge with teeth inserted into the opposite valve; **** hinge toothless, with a hollow rounded receptacle for the cartilage.

M. truncata.—With a strong ovate shell, posterior ends truncated; hinge with a large tooth projecting forwards, and very obtuse; from one to two and a-half inches long, and sometimes three in breadth; white, covered with a yellowish brown epidermis; the valves are very concave, and reflect at the small or truncated end. Inhabits Europe, and is not uncommon in the British seas. Plate 55. Fig. 7.

M. margaritifera.—Shell oblong, ovate, thick, and strong, somewhat indented opposite the hinge; covered with a strong black epidermis, and somewhat decorticated towards the beaks, and frequently perforated with round small holes; inside of a dull pearly hue, streaked with green, bronze, and sometimes pink; teeth strong; in one valve a single tooth, which locks into a bifurcated one in the opposite valve; length two and a-half inches, breadth sometimes nearly six inches. This shell inhabits rapid rivers in most parts of the north of Europe. Wood's *Conch.* Plate 23. fig. 1. 2. 3.

This shell is well known in this country by the name of the pearl muscle. We are informed in the Philosophical Transactions that several pearls of great size have been procured from rivers in the counties of Tyrone and Donegal, in Ireland. One of them weighed 36 carats, and would have been worth L.40, but owing to its being impure it lost much of its value. Other pearls from the same places have sold for L.4, 10s. and L.10. This last one was sold a second time to Lady Glenlealy, who had it placed in a necklace and refused L.80 for it from the Duchess of Ormond. We are told by Camden, that Sir John Hawkins had a patent for fishing pearls in the river Irt in Cumberland. There was also a great fishing for pearls in the river Tay, which extended from Perth to loch Tay; and, it is said, the pearls sent from thence to London, from the year 1761 to 1764, were worth L.10,000 Sterling. It is not uncommon, in the present day, to find pearls in those shells which bring from L.1 to L.1, 10s. each.

Lamarck has divided this genus into four, viz.

Unio,–Shell transverse, having three muscular impressions; an irregular callous hinge: tooth prolonging itself on one side under the cartilage, and articulating with that of the opposite valve. See *Mya Pictorum*, Wood's *Conch.* Pl. 19. fig. 3, 4.

Glycimeris,—Shell transverse, gaping at both ends; hinge callous; without teeth. *Mya siliqua*. Chem. *Conch. t.* 198. fig. 1034.

Mya,—Shell transverse, gaping at both ends; cartilage internal: left valve with a hinge tooth, compressed, rounded, perpendicular to the valve, and giving attachment to the ligament. *Mya truncata*, Pl. 53. Fig. 7.

Vulsella,—Shell free, longitudinal, nearly equivalved, with a flattish callous hinge, without teeth, projecting alike on each valve, with a conical rounded hollow for the cartilage, terminating in a very short bent beak. *Mya Vulsella*. *Encyc. Method. t.* 178, fig. 4. 5.

Forty-one species of mya have been discovered, and fourteen have been found in Great Britain. The marine species are found buried in sand on the seashore, at such a depth that their tubes can reach the surface.

Gen. 5. Solen. *Razor-shell.*

Gen. char.—Animal an ascidia; shell bivalve, oblong, open at both ends; hinge with a subulate reflected tooth, often double, and not inserted in the opposite valve.

They are subdivided into, * shell linear; ** shell ovate or oblong.

S. truncatus,—Shell linear, straight, truncated at one end; hinge with a single opposite tooth in each valve. This shell is covered with saffron yellow coloured epidermis, below which the shell is of a beautiful rosy hue. Of this beautiful species there is another variety, which is shortened and somewhat tapering towards its rounded end. It is this variety we have figured. It inhabits Java and Ceylon; and was long confounded with *S. vagina*, from which it differs, in the cut off appearance of its truncated end, and the teeth appearing close at the edge and having no margin at that end. Plate 53. Fig. 8.

S. radiatus,—Shell oval, straight, and smooth; hinge with two teeth in each valve, and a strong white longitudinal rib. It is about 1¼ inch long and 4 in breadth; very thin and brittle, striated concentrically, and covered with an olive-green epidermis, under which, both without and within, it is of a beautiful violet colour, with from two to four white longitudinal rays, becoming gradually broader towards the margin; it has a strong white depressed rib, extending somewhat obliquely along the inside of the shell. Wood's *Conch. t.* 31. fig. 12. It is an inhabitant of Ceylon, Java, and Amboyna, and may be considered as one of the most beautiful of the genus.

The *solen siliqua* and *ensis*, in many parts of Great Britain, France, and Italy, are used as food, and are to be found on most sandy shores, buried from 18 to 24 inches below the surface, generally near low water mark. Their retreat is easily known by a small hole in the sand. It is capable of moving only in a perpendicular direction, and the long slender form of its shell is admirably adapted for such a purpose; the animal descends to the bottom on the ebbing of the tide, and returns towards the surface as it flows. A little salt put into their holes makes them come to the surface, when they may easily be taken. There are three different ways of taking them;—by enticing them to the surface with salt; by digging them out of the sand with a shovel; or by sticking them with a barbed dart while their necks are protruded in search of food. The solens are called spout-fish in Scotland. It was held as a great delicacy by the ancients.

Lamarck has divided them into two genera:

Sanguinolaria,—Shell transverse, the upper edge arched, a little gaping at the extremities, with two hinge teeth, approximating and articulating on each valve. See *Sanguinolentus*, Wood's *Conch.* Pl. 33. fig. 4, 5.

Solen,--Shell transverse, the upper and lower edges nearly straight; beaks not projecting, gaping at both ends; hinge teeth, single in each valve or double in one; cartilage external. See Plate 53. Fig. 8.

Thirty-five distinct species of solen are known, and we have eleven on our own coasts.

Gen. 6. Tellina. *Tellen.*

Gen. char.—Animal a tethys; shell bivalve, generally sloping on one side; in the fore part at one valve a convex, and at the other a concave fold; hinge with usually three teeth, the lateral ones smooth in one side, and sometimes not existing in the other valve. They are formed into three subdivisions; * shells ovate and thickish; ** shells ovate and compressed; *** shells sub-orbicular.

T. Ferröensis,—Shell ovate, oblong, flat, finely striated transversely with red dotted rays; umbo small and nearly central; two teeth in each valve, without lateral ones; from the umbo to the truncated end of the shell runs an oblique elevated ridge, which gives the striæ at that part an angular appearance; when recent it is covered with a very thin yellowish epidermis; inside smooth and glossy, white, rose colour, or violet, the rays often shining through. Length, three quarters of an inch; breadth 1½ inch. Plate 53. Fig. 9. This shell inhabits the northern ocean, and is found in Britain, though sparingly. It is rather plentiful in Dublin bay and Portmarnock, Ireland.

T. tenuis,—Shell subtriangular, very thin, glossy, brittle, and depressed, finely striated transversely, and somewhat angular before; hinge with a single bifid tooth in each valve; white, red, flesh colour, or yellow, disposed in zones over the surface of the shell; length half an inch, breadth three quarters. Donovan's *Brit. Sh.* Plate 19. fig. 2. This is a European species, and is in general plentiful on all our sandy shores after storms.

The animal inhabiting the tellina differs but little from the cardium and Venus; it has in front two long, simple siphons, the largest is the passage for its food, and the other for excretory matter; and has besides a tongue-shaped muscle, which projects from the hind part, and serves as a foot.

Tellens are found in the ocean, rivers, and lakes; those of the ocean lie buried in the sand or mud near the shore, and sometimes in deep water, and make two small holes in the sand.

Lamarck has made four genera of the tellens, viz.

Cyclas,—Shell nearly orbicular or a little transverse, without any fold on the fore part; cartilage external; fringe with two or three centre teeth, and the lateral ones lengthened, compressed, and intruded. See *Tellina cornea*, Wood's *Conch.* Plate 46. fig. 3.

Lucina,—Shell nearly orbicular or transverse, without any fold on the fore part; one or two centre teeth, and remote lateral teeth. See *Tellina divaricata*, Wood's *Conch.* Plate 46. fig. 6.

Tellina,—Shell orbicular or transverse, having an irregular fold on the fore part; one or two centre teeth, and remote lateral teeth. See *Tellina interrupta*, Wood's *Conch.* Plate 56. fig. 3.

Pandora,—Shells regular, valves unequal, and inequilateral, with two oblong, unequal, and diverging teeth at the centre of the upper valve, and two corresponding hollows in the other valve; cartilage internal, two muscular impressions. See *Tellina inæquivalvis*, Wood's *Conch.* Plate 47. fig. 2, 3, 4.

This seems the best place for inserting Lamarck's genus *Corbula.*

Corbula,—Shell inæquivalve, sub-tranverse, free, and regular, with a conic tooth recurved on each valve; the cartilage internal, with two muscular impressions. See *Chemn. Conch.* vol. x. fig. 1668, and 1671. Eighty-one species of tellens are known, and we have twenty-two of them in Britain.

Gen. 7. Cardium. *Cockle.*

Gen. char.—Animal a tethys; shell bivalve, nearly equilateral, equivalve, generally convex, longitudinally ribbed, striated or grooved, the margin dentated; hinge with two alternate teeth in the middle, near the beak, one of them commonly incurved, and larger remote lateral teeth on one side, each hooking into the opposite.

C. Isocardia,—Shell strong, heart-shaped, of a whitish colour, spotted or clouded with brown; it has about thirty-five longitudinal ribs, covered with erect, arched, hollow scales, placed one above the other like the tiles of a house; inside white, purple in the middle, sometimes yellow or aurora red; margin strongly denticulated; hinge with two primary teeth in each valve, one of which is very strong, erect, conical, and slightly incurvated; lateral teeth in one valve, deeply excavated to receive those of the opposite valve. Plate 53. Fig. 15. The general size of this shell is 2 inches in length, and about $1\frac{1}{2}$ in breadth; but we have a magnificent specimen 4 inches long and $3\frac{1}{4}$ broad. It inhabits the Red sea, Persian gulph, and Jamaica.

C. serratum,—Shell ovate, ventricose, glabrous, very minutely striated longitudinally; of a yellowish colour, stained with orange or purplish brown about the *apex* or margin; the margin in the inside is serrated towards the posterior end. Wood's *Conch.* Pl. 54. fig. 3.

The cockle is a well known article of food; they generally bury themselves in the sand near the coasts. When the animal wishes to sink into the sand, it lengthens its fleshy arm, at the same time diminishing its extremity, so that it becomes pointed. With this it makes a hole and buries the arm in the sand, continuing its operations with the pointed end till it works the shell below the surface. The spined species, being enabled by nature to defend themselves from the attack of other marine animals, keep on the surface of the sand.

This genus is so perfect that no attempt at alteration has been made; the shells are distinct from every other genus, the teeth scarcely ever varying. Lamarck has given his generic character different from that of Linnæus. "Shell somewhat heart-shaped, the valves toothed or folded at the edge; hinge with four teeth, of which the two centre ones are approaching oblique in each valve, articulating crossways with the opposite ones; the lateral teeth remote and intruded."

Of this genus 54 species have been ascertained, and 15 have been discovered on the British coasts.

Gen. 8. Mactra.

Gen. char.—Animal a tethys; shell bivalve, with unequal sides, equivalve; middle tooth of the hinge complicated, with a small hollow on each side; lateral teeth remote and inserted into each other. The subdivisions are, * shells subtriangular, ** shells oblong-ovate.

M. solida,—Shell sub-triangular, thick, opaque, with a few concentric ridges of a yellowish white colour; sides equal, umbo central; lateral teeth large, prominent, and striated; inside glossy white; length an inch and a half, breadth an inch and three quarters. Not unfrequent on the British coasts. Pl. 53. Fig. 10.

M. lutraria,—Shell oblong-ovate, gaping, sub-pellucid, with transverse irregular striae, and somewhat transversely ridged; both sides slope a little from the hinge. It has a strong triangular primary tooth in one valve, and no lateral teeth. Its outer surface is covered with a fine olive-coloured epidermis, sometimes yellowish, and at other times approaching to brown; length $2\frac{1}{2}$ inches, breadth 5 inches. Inhabits European seas, and is plentiful in some parts of Great Britain. Donovan's *Brit. Sh.* II. Plate 58.

The animal of the mactra is nearly allied to that of the cockle; it has two tubes which project out

Bivalves.

a short distance beyond the edge of the shell; it also protrudes a foot at the front towards the lower end.

Lamarck has divided this genus into two, with the following characters:

Lutraria,—Shell transverse and inequilateral; gaping at the extremities; two oblique and diverging hinge teeth, accompanying a large pit for the cartilage; no lateral teeth. See *Mactra Lutraria*, Donovan's *British Shells*, II. Plate 58.

Mactra,—An equivalve, inequilateral, transverse bivalve, a little gaping at the sides; the hinge tooth complicated, with an adjacent little pit; the lateral teeth rather remote, compressed, and inserted; cartilage internal, inserted in the pit of the hinge. See Plate 53. Fig. 10.

Thirty-eight species of mactra have been discovered, and we have twelve in Britain.

Gen. 9. Donax. *Wedge-shell.*

Gen. char.---Animal a tethys; shell bivalve, with generally a crenulate margin; the frontal margin very obtuse; hinge with two teeth, and a single marginal one placed a little behind, rarely double, triple, or none.

D. scripta,---Shell ovate, compressed, smooth, and marked with transverse, zig-zag, or waved lines of purple, reddish-brown, and sometimes orange; two central teeth in one valve, and three in the other, with a lateral tooth on one side; the cartilage is sunk in a groove, and the margin crenulated; length about an inch, breadth an inch and a quarter. Inhabits the East Indies and the Mediterranean. Plate 53. Fig. 11.

D. trunculus,---Shell oblong, smooth, and glossy, finely striated longitudinally, covered with a thin, light yellowish-coloured epidermis; fasciated with purple, with two or three faint white rays from the beak; some are wholly yellow, with darker bands; umbo small, placed near to one end; teeth small, lateral, one not very remote; inside glossy, and partakes of the colour of the outside; shell banded with purple, and in general that colour within; margin crenulated, valves not very concave. Donovan's *British Shells*, I. Plate 29. fig. 1. Inhabits the West Indies, Mediterranean, and British seas.

The shells of this genus are in general triangular, inequilateral, truncated, or concave on the anterior slope, and are for the most part wedge-shaped; the ligament is external, and placed on the shortest side. This but rarely occurs in the inequivalve testacea.

Lamarck has divided this genus into two, as follows:

Petricola,---Shell transverse and inequilateral, gaping a little at both ends, having two muscular impressions, with two hinge teeth on one valve, and a bifid one on the other; cartilage external. See *D. Irus*. Donovan's *Brit. Shells*, I. *t.* 29. fig. 2.

Donax,---Shell transverse, inequilateral; cartilage external; the hinge teeth two, on the left valve; lateral teeth one or two on each valve, rather distant. See *D. cuneata*, Encyclopedie Method. *t.* 261. fig. 5.

Twenty-one species have been discovered of this genus; and six of them inhabit the British seas.

Gen. 10. Venus.

Gen. char.---Animal a tethys; shell bivalve, the frontal margin flattened, with incumbent lips; hinge with three teeth, all of them approximate, the lateral ones divergent at the top.

This genus is divided into the following subdivisions:---* With the anterior depressions spinous, or toothed on the margin; ** somewhat heart-shaped; *** sub-orbicular; **** sub-oval, and slightly angulated on the anterior side.

V. castrensis,---Shell roundish, heart-shaped, ventricose, thick, glabrous, and the posterior depressions marked by a surrounding groove; margin very entire; it is covered with very fine, obsolete, transverse striæ; colour generally white, sometimes clouded or streaked with purple, or dark umber-coloured brown. Plate 53. Fig. 12. This beautiful species is an inhabitant of the East Indies, Amboyna, and Molucca islands.

V. Dione,---Shell somewhat heart-shaped, transversely ribbed, with a double row of incurvated hollow spines on the anterior slope. This shell is of a pink or flesh colour, variegated with white; length an inch and a quarter, breadth an inch and a half. This rare and beautiful species is very valuable when perfect; and inhabits the coasts of Brazil, St Domingo, and Jamaica. Ency. Method. *t.* 275. fig. 1.

The shells of this genus are in general the most beautiful of all the bivalves, not only in form but also in colouring.

Lamarck has removed Venus lithophaga, and a few others corresponding with it, into his genus Petricola, and V. Islandica, &c. into Cyclas, and V. Pensylvanica, &c. into Lucina; and has separated the remaining species into the five following genera.

Paphia,---A sub-transverse inequilateral shell, with close valves, and having the cartilage internal; the pit for its reception is under the beaks, between or beside the teeth of the hinge. See *Venus divaricata*, Lister's *Conch. t.* 310. fig. 146.

Venus,---An equivalved, rather inequilateral bivalve, with three hinge teeth in each valve, converging at their base towards the beaks. The middle tooth, which is sometimes bifid, is placed straight, and one on each side obliquely. See *V. Verrucosa*, Donovan's *Brit. Shells*, II. *t.* 44.

Meretrix,---Shell with two or three approximate hinge teeth converging at the base, with a distant one under the heart-shaped depression in one valve, and a hollow for its reception in the other. See *V. Meretrix*, Ency. Method. Plate 268. fig. 6.

Venericardia,---Shell nearly orbicular, inequilateral with longitudinal ribs on the outer surface; two thick oblique hinge teeth, not diverging. See *Venus discors*. Encyc. Method. *t.* 171. fig. 1.

Capsa,---Shell transverse with two hinge teeth in one valve, and one bifid tooth intruded in the other. See *V. deflorata*, Montagu's *Test. Brit. t.* 3. fig. 4.

Two hundred and eight species of Venus have been ascertained, and twenty-five inhabit the British seas. It is of the *Venus mercenaria*, that the American Indians make their wampum or money, to which they give the name of clams.

Gen. 11. Spondylus. *Hinged Oyster.*

Gen. char.---Animal a tethys; shell hard, solid, and ridged, with unequal valves; one valve in general convex, and the other rather flat; hinge with two recurved teeth, separated by a small hollow.

S. Gaedaropus,—Shell slightly eared, and spinous, generally about two inches in diameter, with the lower valve more convex than the upper one; the shell often scarlet, pink, and yellow, with large foliations. This species is subject to almost endless variety. Plate 54. Fig. 2. Inhabits the East and West Indies, Amboyna, Adriatic, &c.

In Italy this species is considered as excellent food, and is brought to the market of Nice in great numbers. This is a singular shell; the lower valve is produced towards the apex into a projecting beak, one side of which is excavated, so as to leave a flat space perpendicular to the hinge. The teeth in the lower valve are separated by a small hollow that receives the cartilage; but the teeth of the upper valve are separated by three pits, the centre one receiving the cartilage, and the other two the teeth of the opposite valve. They attach themselves to rocks at a great depth in the ocean.

Lamarck divides this genus into two, viz.

Spondylus,—Shell inequivalved, eared, and rough, or spinous, with unequal beaks, the inferior more produced, with a flat triangular face, parted by a groove; the hinge with two strong recurved teeth, and an intermediate hollow for the reception of the cartilage. One muscular impression. See *S. Gaederopus,* Plate 54. Fig. 2.

Plicatula,—Shell inequivalved, without ears, the beaks unequal, without a face, having folds on the margin; hinge with two strong teeth in each valve, and an intermediate hollow for the reception of the cartilage; one muscular impression in each valve. See *S. plicatula,* Lister's *Conch. t.* 210. fig. 44.

Only three species have been discovered of this genus, all foreign. It is probable that *S. Regius* is only a variety of *S. Gaedaropus.*

Gen. 12. Chama. *Clamp.*

Gen. char.—Animal a tethys; shell bivalve, rather coarse; hinge with a callous gibbosity, obliquely inserted into an oblique cavity; anterior slope closed. It is subdivided as follows: *shell detached, **shells adhering to other substances.

C. Gigas,—Shell with remote, broad, rounded longitudinal ribs, armed with vaulted scales, and the posterior slope heart-shaped and gaping. Plate 53. Fig. 13.

This is the largest shell in nature; is of great weight, and varies very much in size. Linnæus informs us of one which weighed 532 Swedish pounds, (which is equal to 498 English;) he adds, that the animal has been known to furnish 120 men with a meal, and that if it shuts its valves suddenly, it can snap a cable asunder. In the library of Sir Joseph Banks, there is a manuscript account of the dimensions of a specimen at Arno's vale, Ireland, which was brought from Tappanooly in Sumatra, one valve of which weighed 285 lbs. and the other 222 lbs. total 507 lbs. The largest valve measured 4 feet 6 inches in length, 2 feet 5½ inches in breadth, and 1 foot in depth. A very large specimen is used at the church of St Sulpice in Paris, as a baptismal font. It was presented to Francis I. by the Venetians. The colour of this shell is dirty white, yellowish, or reddish brown. Large pearls have been occasionally found in this shell; and one exhibited at Sir Joseph Banks's, in June 1814, was valued at between L.200 and L.300.

Lamarck has formed five genera from the chama.

Tridacna,—Shell sub-transverse and inequilateral; the hinge with two compressed teeth inserted, the posterior depression gaping. See *C. Gigas,* Pl. 53. Fig. 13.

Hippopus,---Shell subtransverse and inequilateral; the hinge with two compressed teeth inserted; the posterior depression closed. See *Chama hippopus,* Lister's *Conch. t.* 349. fig. 187.

Cardita,---Shell inequilateral; hinge with two unequal teeth; the one which is short is under the beaks, and the other lengthened beneath the cartilage. See *Chama antiquata,* Lister's *Conch. t.* 346. fig. 183.

Isocardia,---Shell heart-shaped; the beaks distant, turning to one side, and diverging; the hinge with two teeth, flattened and inserted, and one distant lateral tooth under the cartilage. See *Chama cor.* Lister's *Conch. t.* 275. fig. 11.

Chama,---Shell adhering, inequivalved; the beaks unequal; the hinge with one thick oblique tooth; two muscular impressions in each valve. See *Chama Lazarus,* Rumphius' *Conch. t.* 48. fig. 3.

Of this genus twenty-five species have been discovered, and only one, the *C. cor.* inhabits Great Britain.

Gen. 13. Arca. *Ark.*

Gen. char.---Animal a tethys; shell bivalve, equivalve; hinge with numerous sharp teeth, alternately inserted between each other.

Bruguiere's subdivisions are much more distinct than those of Linnæus'; we have therefore adopted them. They are three, as follows: * With the teeth in a straight line; ** with the teeth in a curved line; *** with the teeth in a broken line.

A. Noae,---Shell oblong, rhomboidal, strongly striated longitudinally; colour white, with diagonal, parallel, zig-zag, chesnut, reddish brown, or yellowish-brown stripes, with a dark umber-coloured margin; length about an inch at the anterior end, but considerably less at the posterior end; breadth about two inches; the apices are much incurved, and very remote, with a few distant grooves radiating from the umbo in each valve, or the space between them, which is broad and flat. Inhabits the Red sea, Mediterranean, the Indian ocean, West Indies, and Great Britain. Pl. 53. Fig. 16.

The above species gives the name to the genus, as it is supposed to resemble the hull of a vessel. Many of the arks, however, have not this character, but are sufficiently united to the genus by the number and construction of their teeth.

A. pilosa,---Shell strong, orbicular, covered with a dark-brown hairy epidermis, thickest towards the base; the colour often rusty brown, or white, with zig-zag stripes of chesnut or pale reddish brown; with very fine transverse and longitudinal striae, and antiquated transverse ridges; umbo large, and slightly turned to one side; inside white, sometimes marked with deep orange-brown at one side; margin strongly crenated. Ency. Method. *t*. 310. fig. 2. It inhabits the Mediterranean and Britain. It is used as food on the shores of the Mediterranean.

Lamarck has divided this genus into four, viz.

Nucula,---Shell nearly triangular or oblong inequilateral; the hinge on a line, bent at an angle, furnished with numerous transverse and parallel teeth; a principal tooth oblique, and out of the row; the beaks approximate and turned backwards. See *Arca nucleus*, Donovan's *Brit. Shells*, II. *t*. 63.

Pectunculus,---Shell orbicular, nearly equilateral; the hinge in a curved line, with numerous teeth, oblique and inserted; cartilage internal. See *Arca pectunculus*, Ency. Method. *t*. 311. fig. 5.

Arca,---Shell transverse and inequilateral; beaks distant; the hinge with many teeth in a straight line, transverse, parallel, and inserted; cartilage external. See *Arca Noae*, Pl. 53. Fig. 16.

Cucullaea,---Shell ventricose, nearly transverse, inequilateral; beaks distant; the hinge in a straight line, with many teeth, set transverse and inserted, terminated at each end by two or three parallel to the side; cartilage external. See *Arca concamerata*, Ency. Method. *t*. 304.

Forty-five species of arks have been discovered; six of them are to be found on our shores.

Gen. 14. Ostrea. *Oyster*.

Gen. char.—Animal a tethys: shell bivalve, generally with unequal valves, and slightly eared; hinge without teeth, but furnished with an ovate hollow, and mostly lateral transverse grooves.

It is formed into the following subdivisions: *Valves with the auricles equal; ** valves with the auricles unequal; *** valves more gibbous on one side than the other; **** valves course and rugged; ***** with the hinge composed of transverse furrows in a straight line.

O. varia,—Shell ovate, with about thirty narrow elevated ribs, armed with vaulted spines, and the interstices transversely wrinkled. It is about two inches long, and one inch and three quarters broad, with depressed valves, both nearly equally convex; the auricles are very unequal, the one being four times larger than the other. It varies very much in colour; white, yellow, orange, purple, brown, or pink; sometimes beautifully clouded with darker shades. Plate 53. Fig. 14.

The Ostrea maxima, or great scallop, a shell which inhabits the European seas, is the shell which was worn by pilgrims on the hat or coat, as a mark that they had crossed the sea for the purpose of paying their devotions in the holy land.

The edible oyster is too well known to require description; they have been considered as a delicious food in all ages; and it appears the Romans were very fond of this shell-fish; they were eaten raw, roasted, and stewed.

In the West Indies, there is a species of oyster called *O. arborea*, which attaches itself to trees and twigs which grow in the water, and is well known by the name of the tree-oyster. It is generally on the mangrove tree that this oyster is found. The branches to which they are attached are often cut off and carried home in a basket, and produced at table in this way.

The oysters of Britain are said to be superior to those of all other countries, and are to be found on many of our coasts. Oyster scalps are often formed where they do not naturally inhabit, and those of Colchester have been long famous; and at the mouth of the Thames, they are said to be superior to those of Colchester.

The oyster is a very entertaining object to those who are fond of the microscope. In the clear liquor round the animal, many minute, round, living animalcules have been found, whose bodies being conjoined form spherical figures with tails, not changing their place otherwise than by sinking to the bottom, being heavier than the fluid; these have been seen frequently separating, and then coming together again. A female oyster being opened by Leeuwenhoek, he found multitudes of embryo oysters covered with shells, perfectly transparent, and swimming about in the liquor of the shell. It is supposed the oyster breeds in August. But there is a great penalty in this country for taking them between the 1st of May and the 1st of September. According to the observation of Leeuwenhoek, the fecundity of the oyster is prodigious; as he computes they produce from 3 to 4000 at a time.

The common oyster is possessed of phosphorescent qualities; if the liquor touches the finger, it will shine for some time in the dark.

The Ostrea opercularis, or common scallop, is a most delicious food when stewed; it is not unlike veal in taste, but more tender.

Lamarck has divided this genus into six, as follow:

Ostrea,— Shell adhering, and unequivalved; hinge without teeth; an oblong hollow, with ridges across it for the reception of the cartilage; only one muscular impression on each valve. See *Ostrea edulis* or *Common oyster*.

Malleus,—Shell free, a little open near the beaks, fixing itself by a byssus; the valves equal; the hinge without teeth, a little swelled, and furnished with a conical hollow for the cartilage, placed obliquely on the edge of each valve, separate from the opening for the byssus. See *Ostrea malleus*, or *Hammer oyster*, Ency. Method. *t*. 177. fig. 12. and 13.

Perna,—A flat irregular bivalve, free, and fixing itself by a byssus: The hinge formed of many parallel linear teeth, not articulating, arranged in a transverse straight line. See *Ostrea Ephippium*, Ency. Method. *t*. 176. fig. 2.

Pecten.—A regular, eared, inequivalved bivalve, with contiguous beaks; the hinge toothless, the pit trigonal, receiving the internal ligament; one muscular impression. See Plate 53. Fig. 15.

Lima,—A longitudinal, nearly equivalved, eared bivalve, with the beaks separated by a cavity; hinge toothless; the hinge-pit, which receives the ligament, partly internal and partly external. See *Ostrea lima*, Ency. Method. *t*. 206. fig. 2.

Pedum,—An eared, inequivalved bivalve, gaping at the lower valve, and having its beaks separated; the hinge toothless; the ligament exterior, and fixed in a long and narrow groove; the inferior valve notched. See *Ostrea spondyloidea*, Ency. Method. *t.* 178. fig. 1.

Eighty-three species of this genus have been discovered; nine are inhabitants of Britain.

Gen. 15. Anomia.

Gen. char.—Animal an emarginate, ciliate, strap-shaped body, with bristles or fringe affixed to the upper valve; arms two, linear, longer than the body, connivent, projecting, alternate on the valve and ciliate on each side, the fringe affixed to each valve shell; bivalve, inequivalve, one of the valves flattish, the other gibbous at the base, with a produced beak, generally curved over the hinge; one of the valves perforated near the base; hinge with a linear prominent cicatrix, and a lateral tooth placed within, but on the flat valve on the very margin; two bony rays for the base of the animal.

This is a very ill-defined genus, and would require the following sub-division, although Linnæus has given none: * Perforated at the apex; ** perforated in the disk; *** imperforate.

A. Ephippium,—Shell sub-orbicular, irregularly wrinkled and waved, upper valve convex, under flat, and perforated at the hinge, through which the ligament passes by which it is affixed to other bodies; inside pearlaceous and of various changing colours, from purple, violet, pink, and yellow. Plate 54. Fig. 3. This shell inhabits the Mediterranean and Britain.

Lamarck has formed seven genera from this genus, viz.

Gryphaea,—Shell with unequal valves, the lower one concave, terminated by a beak curved upwards and inwards, the upper valve much smaller, like an operculum; the hinge toothless, the hollow or pit oblong and arched; one muscular impression in each valve. See *Anomia gryphus*, Parkinson's *Organic Remains*, Plate 15. fig. 3.

Placuna,—Shell free, flat, with equal valves, the hinge with two longitudinal teeth or ribs on the interior surface of one valve, diverging in form of a V, and on the other valve two corresponding hollows which serve for the attachment of the cartilage. See *A. placenta*, Ency. Method. *t.* 173. fig. 1 to 3.

Anomia,—Shell irregular with unequal valves, the lower valve perforated near the beak, which aperture is closed with a bony operculum attached to a cartilage passing through the hole or notch, and serving to fix it to other bodies. See *A. ephippium*, Plate 54. Fig. 3.

Crania,—Shell inequivalved, the lower one nearly flat and round, pierced on its inner face with three unequal and oblique holes, the upper valve very convex, furnished on the interior surface with two projecting callosities. See *A. craniolaris*, Ency. Method. *t.* 171. fig. 1. to 7.

Terebratula,—Shell regular, fixed by a ligament or short tube, the valves unequal, the larger of which has the beak produced and pierced with a hole, through which the ligament passes, the hinge with two teeth; two thin branching bony rays projecting inside from the valve that is not pierced, which appear to serve as a stay or support to the animal. See *Anomia terebratula*, Ency. Method. *t.* 239. fig. 1.

Calceola,—Shell with unequal valves, the largest somewhat like a slipper, the smaller one flat and semicircular, like an operculum; the hinge with two or three little teeth. See *A. sandalium*, Knox's *Foss.* 3. Supp. *t.* 206. fig. 5 and 6.

Hyalea,—Shell with unequal valves, swelled and transparent, gaping under the beak, and trciuspidated at the base, valves united. See *A. tridentata*, Shaw's *Nat. Misc.* XVI. *t.* 664.

Thirty species of anomia have been discovered; five are found on the British coasts.

Gen. 16. Mytilus. *Muscle.*

Gen. char.—Animal allied to an ascidia; shell bivalve, rough, generally affixed by a byssus or beard of silky filaments; hinge mostly without teeth, with generally a subulate excavated longitudinal line.

The following are the subdivisions: * Parasitical, and affixed by claws; ** flat or compressed into a flattened form, and slightly eared; *** somewhat ventricose.

M. pellucidus.—Shell thin and pellucid, of a bluish-white colour, radiated with deep blue or purple, covered with a yellow epidermis. In shape it is like the common muscle; inside glossy, the rays shining through crenulations beneath, the beak small. Length two inches, breadth one and a quarter. Plate 54. Fig. 1. Not uncommon on the British coasts.

M. cygneus,—Shell thin, fragile, and semi-pellucid, of an oval shape, wrinkled concentrically, and covered with an olive-green epidermis; umbo very small, placed near one end; inside glossy, pearly white; length 2½ inches, breadth 6 inches. This is the largest of the British fresh water shells, and inhabits lakes and sometimes deep rivers. Donovan's *British Shells*, II. *t.* 55.

The Mytilus Edulis, or edible muscle, is an inhabitant of almost all seas, is very large within the tropics, and gradually diminishes towards the north. It is found in large beds, and is generally esteemed a rich and nutritious food. It is also used with much success as a bait for fishing; the cod and haddock take it with great avidity.

The M. Margaritiferus, or pearl-bearing muscle, is an inhabitant of the Indian ocean; it is a flattened shell, nearly orbicular, with a transverse hinge, imbricated laminæ, toothed in rays. The inside is of a beautiful pearly hue. It is from this shell that true mother-of-pearl is made, and it sometimes produces the most valuable pearls. In the Indian ocean, it is regularly fished for by men who dive for it to the bottom. This is a perilous employment, as the divers are often attacked by sharks, and not unfrequently lose their lives. This shell is often found 12 inches in diameter. See Ency. Method. *t.* 177. fig. 4.

Lamarck places some of the species of mytilus among the ostrea, and divides the others into five genera as follows:

Mytilus,—Shell longitudinal, terminated by a straight beak lengthened to a point, fixing itself by a byssus; hinge generally without teeth; only one muscular impression. See Plate 54. Fig. 1.

Modiola,—Shell sub-transverse, the posterior side very short, with the beaks turning towards the short side; the hinge without teeth, and only one muscular impression. See *mytilus Modiolus*, Donovan's *British Shells*, II. *t.* 15. fig. 5.

Anodonta,—Shell transverse, having three muscular impressions; hinge without any teeth. See *Mytilus cygneus*. Donovan's *British Shells*, II. *t.* 55.

Avicula,—Shell free, valves unequal, a little gaping near the beak, fixing itself by a byssus; the hinge without teeth, a little swelling; the hollow for the cartilage oblong, marginal, and parallel to the edge to which it is attached. See *Mytilus hirundo*, Ency. Method. *t.* 177. fig. 11.

Lingula,—Shell flat, long, with nearly equal valves, truncated before; the hinge without teeth; the beaks pointed and united to a tendinous tube, which serves for a cartilage to the shell, and fixes it to any marine substance. See *Mytilus lingua*, Ency. Method. *t.* 150. fig. 1.

Forty-eight species have been discovered; thirteen inhabit Britain.

Gen. 17. Pinna. *Wing-Shell.*

Gen. char.—Animal a limax; shell sub-bivalve, fragile, upright, gaping at one end, and furnished with a byssus or beard; hinge without teeth, the valves united by a cartilage.

P. muricata.—Shell sub-triangular, with numerous longitudinal ribs, with alternately broader ones, and covered with grooved spines. It is of a horn colour, and pellucid. Inhabits the Mediterranean, Cape, and East Indies. Plate 54. Fig. 4. Length 5 inches, breadth at the base $2\frac{1}{2}$ inches.

The animal inhabiting the Pinna has the power of affixing itself at pleasure to any substance, by throwing out an extensile member, and discharging from its tip a drop of gluten, which, by the retraction of the same organ, is formed into a silky filament; and by frequently repeating this operation, a thick tuft is formed, by which the shell is fastened in any situation the animal chooses. Of these silky filaments, the ancients wove the robes of state for their monarchs, and they are still manufactured at Palermo into gloves, &c.

A small species of crab often takes up its abode within the shell of the pinna, and is said to act as a monitor on the approach of danger. Some have attributed this to a kind of hospitality in the animal giving protection to this intruder, who, it is likely, is an unwelcome guest to the proper inhabitant.

The pinnae are wedge-shaped shells, or somewhat of a triangular form, widening from the top, which is narrow and pointed, to the base, which is wide and extended.

The Pinna rotundata, grows to a very great size, sometimes measuring two feet and a half in length, and nine inches in breadth. It is found in the Mediterranean. Twenty species of Pinna are known; three of them are found in the British seas. The P. ingens is not uncommon about the Hebrides, and is frequently taken a foot in length.

Order III. Univalve Shells.

Division 1. With a Regular Spire.

Gen. 18. Aronauta. *Paper-Sailor.*

Gen. char.—Animal a sepia; shell univalve, spiral, involute, membranaceous, and unilocular, or consisting of a single apartment or cell.

A. Argo,—Shell with a narrow keel, bordered on each edge by a row of conical sharp tubercles; sides nearly flat, with numerous angular waved ridges; colour white; keel often brown, shell very thin and brittle; from which circumstance it has obtained the name of Paper Nautilus in England. Plate 54. Fig. 10.

This shell is the Nautilus of the ancients, mentioned in the writings of Pliny and others. It is supposed, that, in the early ages of society, the art of navigation owed its origin to the expert management of this instinctive sailor. In calm weather it rises to the surface of the water, which it does by ejecting a quantity of water, which renders it specifically lighter than the surrounding fluid. When floating in a calm, it spreads two or more of its tentacula over the shell, and uses them as oars. If a gentle breeze should spring up, it throws out and expands a double membrane, which it can oblique in any direction at pleasure; this answers the purpose of a sail; with the other arms, which answer the purpose of a rudder, it directs its course. Impelled by the breeze, this little animal, in its tender bark, has the appearance of a vessel under sail, and glides along the smooth surface of the ocean. On the approach of danger, he withdraws to his shell, and, by a speedy absorption of the water, he is rendered heavier than the sea-water, and suddenly sinks to the fathomless depths of the ocean. The animal is said to be very quick-sighted, and, on this account is seldom taken when sailing. This shell is an inhabitant of the Mediterranean, the Molucca islands, and Batavia.

Lamarck has divided this into two genera, with the following characters:

Carinaria,—Shell univalve, very thin like a cone, flattened at the sides, the apex terminating in a very small involuted spire, the back having a dentated keel; the aperture entirely oval, oblong, contracted towards the angle of the keel. See *A. vitrea*, Martini, I. *t.* 18. fig. 163.

Argonauta,—Shell univalve, very thin, boat-shaped, the spire rolled into the aperture; the keel of the back doubled and tuberculated. See Plate 54. Fig. 10.

Nine species have been found; but none of this genus inhabits the British seas.

Gen. 19. Nautilus. *Sailor.*

Generic char.—Animal but imperfectly known, (Rumphius Mus. table 17. fig. 13.) shell univalve, divided into several compartments communicating with each other by a siphunculus.

This genus has three subdivisions: * Spiral, with contiguous whirls; ** spiral, with detached whirls; *** elongated, and almost straight.

The dissepiments are convex inwardly, and the chambers become gradually larger from the tip; in the last, or external one, in which the animal is supposed to fix his habitation, keeping up a communication with his interior apartments, or chambers, by means of the hollow tube which passes through them.

N. Pompilius,—Shell with the aperture heart-shaped; whirls obtuse, and smooth; spire involute and concealed. It is usually from five to eight inches in diameter, whitish, with vivid streaks of reddish or yellowish brown, and pearly within. Of this species the inhabitants of the East make drinking cups. They generally remove the epidermis, and the whole outer surface is then pearlaceous. This they ornament highly with different figures, and we have not unfrequently remarked that shells thus disfigured have brought much higher prices than fine and perfect specimens in their natural state. Plate 56. Fig. 13.

Lamarck has divided the nautili into 19 genera; but most of these characters are taken from fossil species. We shall only give those of which there are recent shells.

Nautilus,---a spiral, somewhat wheel-shaped, univalve, the last whorl covering the others, the partitions of which are simple; the chambers numerous, formed by transverse simple partitions, perforated by a tube. See *Nautilus Pompilius*, Plate 54. Fig. 13.

Spirula,---Shell partially or completely spiral and wheel-shaped; the whorls separated, the last whorl especially elongated in a right line, and the transverse partitions simple and pierced by a tube; the aperture circular. See *Nautilus spirula*, Plate 54. Fig. 7.

Orbulites, Ammonites, Planulites, Nummulites, Turrilites, Baculites, Orthocera, Hippurites, Belemnites, Discorbis, Rotulites, Lenticulina, Lituola, Spirolina, Miliola, Renulina, and Gyrogonites, are all fossil genera. See Parkinson's *Org. Rem.* Vol. III. p. 133, &c.

Thirty-six recent species of nautili have been discovered; seventeen are to be found on our coasts.

Gen. 20. Conus. *Cone.*

Gen. char.---Animal a limax; shell univalve, convoluted and turbinated; aperture effuse, longitudinal, linear, without teeth, and entire at the base; pillar smooth.

It is divided into the following sections: * Spire somewhat truncated; ** pyriform, round at the base, and the body whirl half as long again as the spire; *** elongated and rounded at the base, body whirl as long again as the spire; **** ventricose, with a wide aperture.

C. tessellatus,—Shell conical, white, or delicate rose colour, with transverse rows of red or orange spots; base violet, and slightly grooved transversely; generally from 1½ to 2 inches long, and rather more than half that breadth. This beautiful species is an inhabitant of the Indian ocean, and is found in Ceylon and Java. Plate 54. Fig. 14.

The *Cedo nulli*,---a variety of *Conus ammirolis*, or celebrated admiral-shell; it is esteemed the rarest and most precious of testaceous productions. Some specimens have brought the extravagant price of 100 guineas. They are found in South America. The cedo nulli is now made into a distinct species, of which there are several varieties.

The superior beauty of this genus renders it highly interesting. The species are usually covered with an epidermis, and under it they are in general highly polished. This fine surface contributes much to heighten the delicate and glowing tints which are diffused over some of the finer species in an infinite variety of undulations, clouds, spots, and bands.

Of this beautiful genus there are no fewer than one hundred and sixty recent species known, with many varieties. No shells of this genus inhabit the British seas.

Gen. 21. Cypraea. *Cowry.*

Gen. char.---Animal a slug; shell univalve, involute, sub-ovate, smooth, obtuse at each end; aperture effuse at each end, linear, extending the whole length of the shell, and dentated or toothed on each side.

This genus is arranged in four subdivisions: * Spire not quite concealed; ** obtuse, and the spire quite concealed; *** umbilicated; **** with the margin thickened.

C. Argus,---Shell oblong, sub cylindrical; fawn-coloured; the whole upper surface is covered with brown rings, varying in size and thickness; base with four, oblong, transverse, dark-brown spots, length about 3 inches, breadth 1½ inch. Plate 54. Fig. 12.

Inhabits Amboyna, Madras, Java, Ceylon, and Borneo. It is a rare shell.

C. pediculus,---Shell ovate, transversely ribbed with a narrow dorsal groove, with black spots on each side; about half an inch long and a quarter broad; of a flesh colour, generally with more or less of a greyish tint. This is a common West India species, and well known by the name of Sea-louse, or "Blackamoor's teeth." Ency. Method. *t.* 356. fig. 1. a.

This genus is a very natural one, and has undergone no alteration since its first formation. They are all beautiful shells, covered with a high polish, and vivid colouring. It is said that cowries cast their shell periodically, when the animals grow too large for their dwelling, and construct new and larger ones. They live in sand at the bottom of the ocean, but occasionally leave this retreat and crawl upon the rocks, from whence they are often taken alive. The unfinished shells of this genus are frequently mistaken for bullas, as the denticulated outer-lip is the last part of the shell which is formed.

The *C. moneta* is the shell used in Africa and several places of India as money, or circulating medium; it is a white or yellow shell, of an ovate form, with a nodulous margin, varying from half an inch to an inch in length. In England this species bears the name of the trussed fowl, to which it bears a strong resemblance. We have been informed, that an artist in London, a few years ago, formed portraits of small pieces of the Cypræa *tigris*, or leopard cowry, by scraping down the shell to form the shades, &c.

Genus 22. Bulla. *Dipper.*

Gen. char.---Animal a limax; shell univalve, convolute, and unarmed with teeth; aperture a little straitened, oblong, longitudinal, very entire at the base; pillar oblique, and smooth.

B. ampulla,---Shell rounded and opaque; the form approaching to globular; colour white or ash-colour, dotted in waves, and marked with various shades and spots of reddish brown, sometimes with bluish or yellowish-brown transverse bands; apex umbilicated; two inches long, one and a half broad. Inhabits Amboyna, Mauritius, and the East Indies. Plate 55. Fig. 1.

B. Achatina,---Shell spiral, ovate, oblong, with reddish longitudinal bands; pillar truncated and channelled; length sometimes seven inches, and four and a quarter broad. It varies much in colour and markings. The inside is often of a deep crimson or rose colour. The outer surface is finely polished, and with waved or zig-zag markings of bluish grey on a white ground, with the apex crimson or yellow; the body yellow with crimson pillar, or with narrow crowded red bands and a white pillar. This beautiful shell inhabits the American ocean, Cape of Good Hope, and East Indies. Lister's *Conch.* Plate 579. fig. 34.

The *B. zebra*, a land-shell of Africa, is another shell of this genus, approaching to the above in form, and is sometimes found seven inches in length.

The animals of several of the marine bullæ are considerably too large for their shells; and many of them have the shell completely enveloped in the skin of the animal, and appear like mollusca. They have no tentacula, but two small eyes on the top of the head, and a very curious structure of stomach or gizzard.

Lamarck divides this genus into seven, the first of which he places with the naked mollusca.

Bullæa,---Body creeping, oblong-oval, and convex, bordered with membranes which envelope it; the head naked, without tentacula or horns; the hinder part of the body furnished with a broad shield, including and covering the gills, and containing the shell-like body. See *Bulla aperta*, Donovan *Brit. Shells*, IV. *t.* 120.

Ovula,---Shell tumid, more or less elongated to a point; at the two ends the edges rolled inwards; the aperture longitudinal, with no teeth on the left side. See *Bulla ovum*, Ency. Method. *t.* 358, fig. 1.

Terebellum,---Shell nearly cylindrical, spire-pointed; the aperture longitudinal, and narrow at the upper part, with a hollow at the base, and the pillar truncated. See *Bulla terebellum*, Ency. Method. *t.* 360. fig. 1. a, b, and c.

Pyrula,—Shell nearly pear-shaped, channelled at the base, the upper part swelling, with a short spire, without any suture, or ridge, on the outside; the pillars smooth, without any notch or hollow on the right lip. See *Bulla ficus*, Lister's *Conch. t.* 750. fig. 46.

Bulla,—Shell swelled, or gibbous; the spire within concealed; the aperture the whole length of the shell; the right lip acute; no umbilicus at the base. See *B. ampulla*, Plate 55. Fig. 1.

Achatina,—Shell oval, or oblong; the aperture entire, longer than wide; the pillar smooth, truncated at the base. See *Bulla Virginia*, Lister's *Conch. t.* 15. fig. 10.

Volvaria,—Shell convoluted and cylindrical, without any projecting spire, the aperture narrow; the whole length of the shell, with one or more folds at the base of the pillar. See *Bulla cylindrica*, Ency. Method. *t.* 360. fig. 2.

Sixty species of bulla have been discovered; nineteen are inhabitants of Britain.

Gen. 23. Voluta. *Volute.*

Gen. char.—Animal a limax; shell single celled and spiral; aperture without a beak, and somewhat effuse; pillar twisted or plaited, generally without lips or perforations.

The following are the subdivisions: * With the aperture entire; ** subcylindrical and emarginate; *** ovate, effuse, and emarginate; **** fusiform; ***** ventricose, and the summit of the spire papillary.

V. Vexillum,—Shell emarginate, smooth, white, with transverse orange bands, which are generally more or less divided as they approach the outer lip; spire sometimes much produced at the apex; whorls obtusely nodulous; aperture effuse; pillar with eight plates. Shell three inches long, and one and three quarters broad. Inhabits Amboyna, Java, and other places in the Indian ocean. Plate 55. Fig. 6.

Lamarck divides this genus into the nine following genera:

Oliva,—Shell sub-cylindrical, hollowed at the base; the whorls of the spire separated by a channel; pillar obliquely striated. *Voluta porphyrea*, Ency. Method. *t.* 361. fig. 4.

Ancilla,—Shell oblong, the spire short, not channelled; the base of the aperture slightly hollowed and effuse; a thick oblique swelling at the base of the pillar. See *V. oliva*, Ency. Method. *t.* 352. fig. 5.

Voluta,—Shell oval, more or less ventricose; the spire obtuse like a nipple; the base hollowed, without a canal; the pillar with folds, of which the inferior are largest and longest. See *V. musica*, Ency. Method. *t.* 380. fig. 1. and 3.

Mitra,—Shell turreted, or fusiform, with a pointed spire; the base hollowed, without a canal; the pillars with folds, the inferior ones of which are smallest. See *V. episcopalis*, Ency. Method. *t.* 369. fig, 2.-4.

Columbella,—Shell oval, with a short spire; the base of the aperture more or less hollowed, without a canal, having a swelling on the internal part of the right lip, and folds, or teeth, on the pillar. See *V. mercatoria*, Ency. Method. *t.* 375. fig. 4.

Marginella,—Shell oval, oblong, smooth; spire short, the right lip with a margin thickened on the outside; the base of the aperture more hollowed, with folds on the pillar. See *V. glabella*, Ency. Method. *t.* 377. fig. 6.

Cancellaria,—Shell oval, or a little turreted, with the right lip sulcated internally; the base of the aperture with a slight channel, almost entire; some folds on the pillar, sharp or compressed. See *V. cancellata*, Lister's *Conch. t.* 830. fig. 53.-4.

Turbinellus,—Shell turbinated or sub-fusiform, with a channel at the base; the pillars with three to five compressed transverse folds. See *Voluta pyrum*, Ency. Method. *t.* 390. fig. 2. *a*, *b*, *c*.

Auricula,—Shell oval or oblong; spire protruded; the aperture entire, longer than wide, narrowed upwards; pillar with one or more folds. See Lister's *Conch. t.* 1058. fig. 6. *V. Auris midae.*

One hundred and eighty-six species of volutes have been discovered; ten are inhabitants of the British seas.

Gen. 24. Buccinum. *Whelk.*

Gen. char.—Animal a limax; shell univalve, spiral, gibbous: aperture ovate, terminating in a short canal, leaning to the right, with a retuse beak, or projection; pillar lip expanded.

Subdivisions,—* Inflated, rounded, thin, slightly transparent, and brittle; ** with a short, exserted, reflected beak, and the outer lip unarmed outwardly; *** resembling the last division, but the outer lip on the outside is spinous at the base; **** with the pillar-lip dilated and thickened; ***** with the pillar-lip appearing as if worn flat; ****** somewhat polished, and not enumerated in the former divisions; ******* angulated, and not included in the former divisions; ******** turreted, subulate, and slightly polished.

B. Perdix,—Shell from three to five inches long, and about three-fourths as broad, thin, brittle, of a greyish pale brown, or fawn colour; longitudinally undulated with white spots; ovate, inflated, slightly grooved, and undulated with white; aperture without teeth; the ribs formed by the shallow transverse grooves, of which there are about 20 on the body, which are more or less flat, and the pillar is sub-umbilicated. Plate 55. Fig. 2.

The Buccinum lapillus, or common horse-whelk, which is one of the most common species on our shores, adhering to stones, &c. is the shell from which the famous purple dye, called the *Tyrian purple,* is extracted; it is found in a vein on the back of the animal. The B. undatum, or common whelk, is by many people considered good food. It is also used as a successful bait in fishing for cod and haddocks.

Lamarck has divided this genus into eight, as follow:

Nassa,—Shell oval, the aperture terminating at the lower end in an oblique hollow, turning upwards towards the back; the left lip thickened, forming, on the pillar which it covers, a transverse fold at the upper part, and having its base obliquely truncated. See *B. Arcularia,* Encyc. Method. *t.* 394, fig. 1. 2.

Purpura,—Shell oval, generally rough, with spines or tubercles; the aperture ending at its base in a short oblique channel, hollowed at the extremity; the pillar naked, flat, and terminating in a point at the base. See *Buccinum lapillus,* Donovan's *Brit. Shells,* I. *t.* 11.

Buccinum,—Shell oval or lengthened; the aperture oblong, with a hollow at the base, without a canal; the hollow is uncovered at the front part; pillar convex, and full, without any flattening at the base. See *Buccinum undatum,* Donovan's *Brit. Shells,* III. *t.* 104.

Eburna,—Shell oval or elongated, smooth, the right edge very entire; the aperture oblong, with a hollow at the base; the pillar umbilicated, and slightly grooved at the base. See *Buccinum glabratum,* Encyc. Method. *t.* 401. fig. 1.

Terebra,---Shell turreted, the aperture with a hollow at the base, and about one-third of the length of the shell; the base of the pillar twisted or oblique. See *Buccinum maculatum,* Ency. Method. *t.* 402. fig. 1.

Dolium,—Shell swelled, nearly globular, with circular ribs; the right lip toothed or crenated its whole length; the aperture oblong, very large, with a hollow at the base. See *Buccinum dolium,* Ency. Method. *t.* 403. fig. 3.

Harpa,—Shell oval, or ventricose, with longitudinal sharp ribs; the aperture oblong, large, with a hollow at the base, and no canal; the pillar smooth, ending in a point. See *Buccinum harpa,* Ency. Method. *t.* 404. fig. 1.-4.

Cassis,---Shell ventricose, the aperture longitudinal, terminating at the base in a short canal, bent towards the back of the shell; the right lip margined outwardly; the pillar with folds at the lower end. See *Buccinum cornutum,* Lister's *Conch. t.* 1006. fig. 70.

One hundred and fifty-eight species of buccinum have been discovered, and eighteen have been found in the British seas.

Gen. 25. Strombus. *Screw.*

Gen. char.---Animal a limax; shell univalve and spiral; aperture much dilated; the lip expanding, and produced into a groove leaning to the left.

This genus is formed into the following subdivisions: * With linear segments or claws at the margin of the outer-lip; ** with the outer-lip lobed; *** with the outer-lip very large; **** turreted with a very large spire.

S. Auris Dianae,—Shell transversely ribbed, and nodulous, and the spire rather short; outer lip pointed above, and the beak at the base of the aperture recurved; two and a-half or three inches long, and more than half as broad, with transverse ribs, and from one to three rows of tubercles on the body-whirl; the spire is nearly as long as the body-whirl; the outer-lip turned upwards; the colour is white, variously mottled with brown or fawn-colour, and the throat is more or less tinged with orange. Inhabits the Asiatic ocean, Amboyna, and China. Plate 55. Fig. 3.

The shells of this genus are commonly thick and strong, many of them with strong horns or claws, which extend in various directions from the edge of the outer-lip; but these are only formed when the shell is full grown, so that in their young state they are frequently mistaken for shells of different genera, such as cones, murices, &c. The Strombus chiragra, a beautiful and large shell of this genus, a native of Java and Amboyna, is known in England by the name of devil's claw; and the S. lambis by the name of spider-shell.

A very remarkable peculiarity of this genus is, the impression of the outer lip, which is situated near the base, but is not at all connected with the channel of the rostrum or beak. This is a better mark of distinction than the direction of the beak. Several of the species in the last division, however, are without this mark, having only the oblique turn of the canal to connect them to this genus, and they are very closely allied to many of the tapering murices in the form of the mouth.

Lamarck has divided this genus into three, as follow:

Strombus,—Shell ventricose, the base terminating in a short, hollow, or truncated canal; the right lip enlarges with age into a wing, entire, or with only one lobe, having at the lower part a hollow or groove, distinct from that at the base. See *Strombus pugilis*, Ency. Method. *t.* 408.

Pterocera,—Shell ventricose; the base terminating in a lengthened canal; the right lip dilating with age into a digitated wing, and having a hollow groove near the base. See *Strombus scorpius*, Lister's *Conch. t.* 870. fig. 24.

Rostellaria,—Shell fusiform, the base terminating in a canal like a sharp beak; the right lip entire, or toothed, more or less dilating with age into a wing, and having a hollow very near to the canal. See *Strombus Fusus*, Lister's *Conch. t.* 854. fig. 12.

Forty-three species of Strombus have been discovered, and only two inhabit the British seas.

Gen. 26. Murex. *Rock*, or *Caltrop*.

Gen. char.—Animal a limax; shell univalve, spiral, rough, with membranaceous sutures; aperture oval, ending in an entire straight or slightly ascending canal.

Linnæus divides this genus into six subdivisions: * Spinous, with a produced beak; ** foliated, and the beak short; *** with thick, protuberant, rounded varices; **** somewhat spinous, and without a beak; ***** unarmed, with a long, straight, subulate beak; ****** turreted and subulate, with a very short beak.

M. Haustellum,—Shell sub-ovate, with three thick varices, remote pointed tubercles, and intermediate smaller ribs: beak long, subulate, and straight, about four inches long, the beak being nearly two and a half, and in breadth one inch and a-half; both the varices and tubercles are transversely grooved; the colour is whitish, with reddish brown spots and bands, with the throat white. Inhabits Java, Ceylon, Amboyna, and the Red sea. Plate 55. Fig. 14. This is termed the Snipe in England.

M. tribulus, or thorny woodcock,—Shell sub-ovate, with three varices, from which issue a number of long sharp spines, and are extended to the extremity of the beak; the interstices are slightly nodulous, transversely ribbed, and marked with cancellated striae; the colour is dirty, or pale brownish white; the beak is long and straight, and armed with spines; five inches long, the beak being about three, breadth of the body-whirl one inch and a-half. This curious and elegant shell is a native of the Asiatic ocean, and is to be found in Java, Ceylon, and Amboyna. Lister's *Conch. t.* 902. fig 22.

The form of the aperture in this genus is one of its most distinctive characters. It is oblong-oval, or oval, seldom ovate, and abruptly opens into a canal, and sometimes almost the same width throughout, and is even more to be depended on than the straight beak.

The *Murex antiquus* is the largest spiral shell which inhabits the British seas, and is used by poor people as an article of food in many places, and is an excellent bait for cod, &c. It lives in deep water, and can only be got by the dredge: it is sometimes, also, found adhering to the fishermen's lines. We have a curious account of the mode in which the fishermen procure this shell in Argyleshire, in the eighth volume of the Statistical Account of Scotland. It is detailed in the following words: "At the beginning of the fishing a dog is killed and singed, and the flesh, after rotting a little, is cut into small pieces, and put into creels, or baskets, made of hazel-rods, for the purpose. These creels are sunk by means of stones thrown into them. The flesh of the dog, in its putrid state, is said to attract the whelk, which crawls up round the sides of the basket, and getting in at the top cannot get out again, owing to the shape of it, which is something like that of the wire mouse-trap. After the first day's fishing the heads and entrails of the cod, with skate and dog-fish, are put into the creels, which are visited every day, the whelks taken out, and fresh bait of the same kind put in, there being no more occasion for dog's flesh." The *Murex Tritonis*, or Triton's trumpet, is a large shell, often measuring sixteen inches in length, and eight in breadth. It is used by the Africans and many of the eastern nations as a bugle horn, and by the natives of New Zealand as a musical instrument. Two or three of the upper volutions are ground off, and from the number of its turnings it has much the effect of a horn; and we are informed that many of the Africans can bring out a number of tones, and use it with great effect. Its sound can be heard at a great distance. The *Murex trunculus* an inhabitant of the Mediterranean, Red sea, coasts of Jamaica, and other West India islands, a shell of about three inches long, is the species from which the ancients chiefly extracted the beautiful purple colour, known by the name of the Tyrian dye.

Lamarck has formed five genera of this.

Murex,—Shell oval or oblong, with a channel at the base, having always on the outside some longitudinal ridges, generally rough, with tubercles, or spines, or fringed. See *Murex haustellum*, Plate 55. Fig. 14.

Fusus,—Shell somewhat spindle-shaped, swelling in the middle or lower part, with a channel at the base: the spire lengthened and destitute of sutures or ridges on the outside; the pillar smooth, the right lip without a notch. See *Murex colus*. Ency. Method. *t.* 423. fig. 4-5. and 424. fig. 4.

Fasciolaria,—Shell somewhat spindle-shaped, with a channel at the base, and without sutures, having on the pillar two or three very oblique folds. See *Murex tulipa*, Ency. Method. *t.* 451. fig. 2.

Pleurotoma,—Shell somewhat spindle-shaped, the aperture terminating at the base in a long canal, with a notch or hollow, at the upper part of the right lip. See *Murex Babylonius*, Ency. Method. *t.* 439. fig. 1, 5, and 6.

Cerithium,—Shell tapering, the aperture oblique, terminating at the base in a short canal; truncated, or recurved, with a groove at the upper end of the right lip. See *Murex aluco*, Ency. Method. *t.* 453. fig. 5.

One hundred and sixty-four species of Murex have been discovered, and twenty-two have been found on the British coasts.

Gen. 27. Trochus. *Top-shell.*

Gen. char.—Animal a limax; shell univalve, spiral, more or less conic; aperture somewhat angular, or rounded, the upper side transverse and contracted; pillar placed obliquely.

The following are the Linnæan subdivisions: * Umbilicated and erect; ** imperforate and erect; *** tapering, with the pillar exserted, and the shell falling to one side when placed upon its base.

T. zizyphinus,—Shell conic, terminating in a sharp apex, with seven or eight volutions, with several spiral ridges; the first of these in each volution is in general more prominent than the rest, and serves to define their divisions; colour livid or reddish, sometimes approaching to purple, streaked with longitudinal, broad, waved lines of dark reddish purple, which are always darker on the largest ridge at the bottom of each volution; aperture somewhat compressed and angulated. Inside pearly; base rather flattened, with strong circular striae paler than the rest of the shell, and without spots. Inhabits Britain, Mediterranean, and the Red sea. Plate 55. Fig. 8.

Lamarck has divided this genus into the following five:

Trochus,—Shell conic, with a transversely depressed, and nearly quadrangular aperture, and an oblique axis. See *Trochus Niloticus*, Lister's *Conch. t.* 617. fig. 3.

Solarium,—Shell depressed, conical, having an open umbilicus, crenulated at the internal margin of the windings of the spine at its base; the aperture nearly quadrangular. See *Trochus perspectivus*, Lister's *Conch. t.* 636. fig. 24.

Monodonta,—Shell oval or conoid, the aperture entire, and roundish, with the two margins disunited at the upper part, the projecting, truncated, or shortened base of the pillar forming a tooth projecting into the opening. See *Trochus lobio*, Lister's *Conch. t.* 584. fig. 42. and *t.* 645. fig. 37.

Phasianella,—Shell solid, ovate, or conical, the aperture longitudinal, ovate, and entire, with a sharp plain lip; the pillar smooth, with an attenuated base. See *Buccinum australe*, Chemnitz *Conch* IX. Part 2. p. 38. *t.* 120. fig. 1033. and 1034.

Pyramidella,—Shell tapering; the aperture entire and semi-oval; the pillar projecting, with three transverse folds, and perforated at its end. See *Trochus dolabratus*, Lister's *Conch. t.* 844. fig. 72. b.

One hundred and twenty-eight species of Trochus have been discovered, and twelve are natives of Britain.

Gen. 28. Turbo. *Wreath.*

Gen. char.—Animal a limax; shell univalve, spiral, and solid; aperture contracted, orbicular, and entire.

It has been separated into six subdivisions, viz. * Imperforate, and the pillar-lip flat; ** imperforate and solid; *** umbilicated and solid; **** cancellated; ***** turreted; ****** depressed.

T. Chrysostomus,—Shell sub-ovate, with five or six produced transversely angulated whirls, which are ribbed transversely and longitudinally wrinkled; on the angulated keel of each whirl there is a row of vaulted spines, and also another row towards the base of the body whirl. The inside of full grown shells is of a rich glittering gold colour, about two inches and a quarter long, and one inch and three quarters broad Plate 55. Fig. 4.

The *Turbo scalaris*, or Wentletrap,—is a conical shell, with eight rounded detached whirls, connected together by longitudinal ribs; of which eight are on the body whirl; the aperture is margined; it is generally of a snowy white, or pale flesh-colour. This valuable and rare shell is about an inch and a-half, or sometimes two inches in length; its breadth is about three-fifths of its length. Large and perfect specimens of this shell formerly sold at very high prices, and it still retains its value. Da Costa informs us that, in 1753, at the sale of Commodore Lisle's collection, four of them sold for the following prices: First day, lot 96, one not quite perfect, L.16, 16s.; third day, lot 98, a very fine and perfect one, L.18, 18s.; fourth day, lot 101, one for L.16, 16s.; sixth day, lot 83, one for L.23, 2s; and there is one at present in the collection of Mr Bullock, which has been valued at 200 guineas; and it is said that the late Mr Webber, who brought it from Amboyna, and in whose collection it remained during his life, refused the sum of L.500 offered for it by the Earl of Bute. This shell inhabits Amboyna, Tranquebar, Batavia, Japan, and the Philippine islands. Rumphius's *Conch. t.* 49 fig. 4. *Turbo principalis* is another shell approaching in form to the scalaris: it is much narrower in proportion to its length, is imperforate, and has the whirls contiguous and marked with cancellated striae of a white colour. It inhabits the coasts of Coromandel. Chemnitz, XI. *t.* 195. A. fig. 1876, and 1877. The *Turbo clathrus*, or false wentletrap, inhabits Britain. It is an imperforate shell, turreted with rounded sub-contiguous whirls, and thick longitudinal distinct ribs; about an inch and a quarter long, and one-third as broad. Donovan's *Brit. Shells,* I. *t.* 28.

Lamarck divides the turbines into five genera, viz.

Turbo.—Shell conic, or slightly tapering; the aperture entire and round, and not toothed; the two lips always disjoined in the upper part. See *Turbo cochlus*, Lister's *Conch. t.* 584. fig. 40.

Cyclostoma,—Shell wheel-shaped, or conical, without longitudinal ribs, the last whorl larger than the others; the aperture round: the margin circular and uninterrupted. See *Turbo Delphinus*, Lister's *Conch. t.* 608. fig. 45.

Scalaria,—Shell tapering, with acute longitudinal raised ribs down all the length of the spire; the aperture nearly circular: the margin uninterrupted and reflected. See *Turbo scalaris*, Rumphius's *Conch. t.* 49. fig. A.

Turritella,—Shell tapering; aperture rounded, with the two lips disjoined in the upper part, and a notch in the right lip. See *Turbo terebra*, Donovan's *Brit. Shells*, I. *t.* 22. fig. 2.

Pupa,—Shell cylindrical, the last turn of the spire somewhat produced, not being larger than the preceding; the aperture irregularly rounded, or oval; the margin continued circularly. See *Turbo Uva*, Gualtieri's *Conch. t.* 58. fig. D.

One hundred and sixty-three species of Turbo have been found, and sixty-nine inhabit Britain.

Gen. 20. *Helix*. Snail.

Gen. char.—Animal a limax; shell univalve, spiral, sub-diaphanous, brittle; aperture contracted, semilunar, or roundish.

This genus is formed into six subdivisions: * Whirls longitudinal, angulated on both sides; ** with a carinated margin on the body-whirl; *** umbilicated, and the w irls rounded; **** imperforated, and the whirls rounded; ***** turretted; ****** ovate and imperforate.

H. pomatia,—Shell sub-globose, moderately strong, and sub-pellucid with five rounded volutions, strongly wrinkled longitudinally; colour yellowish brown, commonly with three faint bands on the body, one of which continues round the second spire, aperture semilunated; margin rather thickened, and turns a little outwards; pillar-lip much reflected over the umbilicus; diameter about two inches. Plate 55. Fig. 5.

This shell is the largest land species found in this kingdom. It is not, however, an aboriginal, but was introduced from Italy about the middle of the sixteenth century by Mr Howard of Albury, and turned out in Surrey, where it has increased very much, and is the most common species in that and the neighbouring counties. They are commonly used as food in many parts of Europe, especially during lent. They were a very favourite dish with the Romans, who had nurseries for them formed of wicker work; these they called *cochlearia*. There they fattened them with bran and sodden wine.

The snail is possessed of considerable reproductive powers. Spallanzani found that the whole head might be cut off, and that in a certain time another would be formed. It is also said they are very tenacious of life. We are informed that a Mr Simon of Dublin had been left a collection of shells, &c. by his father, and among them there were some snail shells. About fifteen years after his father's death he took some of these snails from the cabinet, and gave them to his son, a boy of ten years of age, to play with. On being put into water, and allowed to remain a day, the animals came out of their shells.

We find the following singular account of the tenacity of life in the snail, in the Annual Register, transmitted by a Mr Rowe. "I was at Mr Haddock's (says Mr Rowe) at Wortham, in Kent, and was making a little shell-work tower, to stand on a cabinet in a long gallery. After having repaired two small amber temples to grace the corners, I was desirous of having some ornament for the front; and sea shells running short before I had finished, I recollected having seen some pretty little snails on the chalk hills there, and we all went out one evening to pick up some. On our return I procured a large china basin, and putting a handful or two of them into it, filled it up with boiling water. I poured off the first water, and filled the bowl again. I then carried it into a summer-house in the garden, where I loved to work early in the morning, before my friends were stirring. Next morning how great was my surprise, on entering the summer-house, to find my poor snails crawling about, some on the edge of the basin, some tumbling over, some on the table, and one or two actually eating paste that was to stick them on! and picking up every snail carefully, carried them into a field beyond the garden, where I make no doubt but they perfectly recovered their scalding."

The *Helix Janthina* is a native of the seas around the West India islands. It is a roundish, diaphanous, and brittle shell, of a violet colour; the animal, when alive, shines by night, and stains the hand with a violet or purple dye. A curious account of this shell is given by Brown, in his Natural History of Jamaica, —he calls it the purple ocean shell. "The creature which forms and inhabits this shell is a native of the ocean, and lives frequently many hundred leagues from any land but having met with many of the kind between Bermudas and the Western Islands, in my voyage from Jamaica, it enabled me to communicate the following account of them.

"The creature probably passes the greater part of life at the bottom of the sea, but rises sometimes to the surface, and to do so, it is obliged, as other fishes, to distend an air-bladder, which, however, is formed only for the present occasion, and made of tough viscid slime, swelled into a vesicular transparent mass, that sticks to the head of the animal, at the opening of the shell. This raises and sustains it while it pleases to continue on the surface; but when it wants to return, it throws off its bladders yet affixed to the aperture of the shell; and I still preserve some with it on, in spirits. I have also observed many of the vesicles themselves swimming upon the surface of the water about that place, which induced me to think they were thrown off as the creature retired. It is observable, that, on touching the body of this insect, it diffuses a beautiful purple liquor, of which colour the shell generally appears when fresh." Many hundreds of this shell were found at Portrush, county of Antrim, Ireland, after a storm, with the animal alive in them. Some were found floating on the surface of the water, and were buoyed up by a reticulated membrane of a purple colour, as above mentioned, by Brown. It was supposed these shells must have been driven from their native seas by a strong westerly wind, which prevailed for six weeks at that time. But since that period several specimens have been found on the east coast of Ireland.

Lamarck has divided this genus into the eight following genera.

Janthina,—Shell nearly globular, transparent; the aperture triangular, with an angular hollow or notch on the margin of the right lip. See *Helix Janthina*, Lister's *Conch. t.* 572. fig 24.

Bulimus,—Shell oval or oblong, having the last whorl of the spire larger than the former; the aperture entire, longer than it is broad; the pillar smooth, the base entire, and not spread out. See *Helix oblonga*, Lister's *Conch. t.* 23. fig. 21.

Lymnæa,—Shell oblong, rather tapering; the aperture entire, longer than wide; the lower part of the right lip reascending and turned back into the aperture, and forming a very oblique fold on the pillar. See *Helix stagnalis*, Donovan's *Brit. Shells*, II. *t.* 51. fig. 2.

Melania,—Shell turreted; aperture entire, longer than wide, and spreading at the base of the pillar, which is smooth. See *Helix Amarula*, Lister's *Conch. t.* 133. fig. 33.

Ampullaria,—Shell globular, ventricose, umbilicated at the base; the aperture entire and longer than wide, without any thickening on the left lip. See *Helix ampullacea*, Lister's *Conch. t.* 130. fig. 30.

Planorbis,—Shell wheel shaped; spire not projecting, flattened, or sunk in; the aperture entire, longer than wide, hollowed laterally by the convex projection of the last whorl but one. See *Helix cornu-arietis*, Lister's *Conch. t.* 136. fig. 40.

Helix,—Shell globular or orbicular, with a convex or conic spire; aperture entire, wider than long, hollowed at the upper part by the convex projection of the last turn but one. See *Helix pomatia*, Plate 55. Fig. 5.

Sigaret,—Shell depressed, somewhat ear-shaped; spire short, and little elevated; the aperture entire, spread out very wide. See *Helix haliotoidea*, Lister's *Conch. t.* 570. fig. 21.

The following genus is most nearly allied to Helix, though it might with more propriety be placed between Turbo and Helix.

Testacilla,—Shell univalve, obliquely conic, the summit a little spiral; aperture oval, the left lip rolled inwards. See *Helix scalaris*, Favanne, *t.* 76. fig. L.

One hundred and ninety-one species of Helices have been discovered; sixty-seven are natives of Britain.

Gen. 30. Nerita. *Nerite.*

Gen. char.—Animal a limax; shell univalve, spiral gibbous, flattish at bottom; aperture semi-orbicular, or semi-lunar; pillar lip transversely truncated, flattish.

Subdivisions: * Umbilicated; ** imperforate, with the pillar lip toothless; *** imperforate with the pillar lip toothed.

N. Peloronta,—Shell somewhat ribbed transversely, and the spire pointed; inner lip concave, with two or three large teeth, and a saffron or blood-coloured irregular spot in the middle; aperture bluish-white; the whole external surface is of a pale grey colour, with irregular black and red, or dark purple longitudinal zig-zag stripes; diameter about an inch and a quarter. This shell is termed the bloody-tooth; it inhabits the coasts of Banda, Barbadoes, Jamaica, Red sea, and Molucca islands. Plate 55. Fig. 11.

Lamarck has divided this genus into three, viz.

Nerita,—Shell semi-globose, flattened beneath, and having no umbilicus; the aperture entire and half round; the pillar nearly transverse, with an acute and generally dentated edge. See *Nerita peloronta*, Plate 55. Fig. 11.

Natica,—Shell nearly globular, umbilicated, the left lip thick towards the umbilicus; the aperture entire and half round; the pillar oblique, without teeth. See *Nerita canrena*, Lister's *Conch. t.* 560. fig. 4.

Neritina,—Shell generally sub-oval, spiral, aperture lunated and toothless. See *Nerita fluviatilis*, Lister's *Conch. t.* 141. fig. 38.

We may place here Lamarck's genus Helicina, as it is certainly more allied to the Nerita than the Helix.

Helicina,—Shell somewhat globular, no umbilicus; the aperture entire, semi-oval; the pillars thickened, compressed at the base. See *Helix neritella*, Lister's *Conch. t.* 61. fig. 59.

Sixty-five species of Nerites have been discovered; eight have been found in Britain.

Gen. 31. Haliotis. *Sea-Ear.*

Gen. char.—Animal a limax; shell ear-shaped, univalve, and dilated, with a longitudinal row of orifices along the surface; spire lateral and nearly concealed.

H. parva,—Shell ovate, depressed, with decussated striæ and three elevated remote ribs; the tubercles on the middle one are slightly raised, and five or six are perforated; spire elevated. It is an inch and a half long, and about two-thirds as broad, of an orange-red, sometimes marbled with ash-colour or brown; inside iridescent. Inhabits Africa, at the Cape, Isle of France, and China. Plate 55. Fig. 7.

The shells of this genus are very distinct from all others, and possess two very strong characters, that of being ear-shaped, and the inside being pearlaceous and highly iridescent.

Lamarck has divided this genus into the two following:

Stomatia,—Shell oval or ear shaped, with a prominent spirl; the aperture large, entire, longer than wide; the disk imperforate. See *Haliotis imperforata*, Ency. Method. Plate 450. fig. 5. a, b.

Haliotis,—Shell flattish and ear-shaped, with a depressed and nearly lateral spire, and a spiral row of orifices parallel to the left edge; the aperture very large, and longer than wide, entire,

The *H. tuberculata* is a shell found plentifully at Guernsey, adhering to rocks at the lowest ebb; the animal of which is used for food, and when fried is said to taste like veal.

Seventeen species of Haliotis have been discovered, and only one has been found in Britain.

Division 2. Shells without a Regular Spire.

Gen. 32. Patella. *Limpet.*

Gen. char.—Animal a limax; shell univalve, subconic, shaped like a basin; without a spire.

This genus is formed into seven subdivisions, viz. * With an internal appendage at the summit; ** with an internal transverse partition; *** with the margin angular, or irregularly toothed; **** with the summit pointed or recurved; ***** with the summit obtuse and the margin entire; ****** with a marginal fissure; ******* with the summit perforated.

P. vulgata,—Shell conic, oval; the vertex nearer one end, which is usually smaller, sometimes very nearly central, marked with numerous fine striæ from the apex to the margin, which is often a little dentated, and sometimes quite plain; colour on the outside yellowish, horn colour, or brown; inside yellow, orange, or white, with rays of a purple, blue, or chocolate brown, diverging from the aperture to the base.

This shell is subject to great variety, not only in colour, but also in the striæ; some are strongly ridged, and others are only finely striated. It is an inhabitant of all seas. Plate 55. Fig. 10. This shell is frequently made use of as food, and is an excellent bait for small fish; and is eagerly sought after by fishermen for that purpose.

P. porcellana,—Shell oval, depressed, with the margin entire, and the summit recurved; internal partition flat; length one inch and a quarter, breadth not quite an inch; of a whitish, or brownish colour, variegated with blotches of purple or chesnut brown; inside white and glossy, with an internal transverse partition, extending considerably more than half the length of the shell. Inhabits the coasts of Goree and Indian ocean. Plate 54. Fig. 6.

The animal of the Patella is not unlike that of the Haliotis; it has a cylindrical head, two tapering nearly cylindrical horns, with the eyes on the external side of the base; this animal is scarcely capable of extending any part beyond the shell more than the tips of the horns.

Lamarck has divided the genus Patella into the following eight genera:

Patella,—Shell oval or shield-shaped, not spiral, without perforation or marginal fissure. See ***Patella vulgata***, Plate 55. Fig. 10.

Fisurella,—Shell buckler or shield-shaped, without a spire, concave beneath, the vertex perforated with an ovate or oblong opening See *Patella Graeca*, Donovan's *Brit. Shells*. I. Plate 21. fig. 3.

Emarginula,—Shell like a conical shield, the vertex inclined, and the posterior margin slit or notched. See ***Patella fissura***, Donovan's *Brit. Shells*, I. Plate 3. fig. 2.

Crepidula,—Shell oval or oblong, convex above, with its apex inclined to one end, and its cavity partially interrupted by a horizontal division. See ***Patella fornicata***, Lister's ***Conch. t.*** 545. fig. 33. and 35.

Concholepas,—Shell oval, convex above, the apex obliquely inclined to the left side; the interior cavity simple; with two teeth and a hollow at the base of the right edge. See ***Buccinum concholepas***, Chemnitz *Conch*. X. Vig. 25. at p. 320. fig. A and B.

Calyptrea,—Shell somewhat conic, with the apex erect, entire, and pointed; the cavity furnished with a convoluted lip or little tongue, like a horn, isolated or extending from one side like the blade of a knife, running spirally. See ***Patella equestris***, Lister's *Conch. t.* 346. fig 38.

Acardo,—Shell formed by two flattened and nearly equal valves, having neither hinge nor cartilage, but a muscular impression in the middle of the valves. See ***Patella umbellata***, Martini's ***Conch***. I. page 103. Plate 6. fig. 44.

Orbicula,—Shell orbicular, flat, composed of two valves, the lowest valve very thin, and adhering to other bodies; the hinge unknown; the animal furnished with two long arms, like ***Anomia terebratula***. See ***Anomia turbinata***, Poli Testacea, II. page 189. Plate 30. fig. 15.

One hundred and three species of Limpets have been discovered, and fourteen have been found in Britain.

Gen. 33. Dentalium. *Tooth-shell.*

Gen. char.—Animal a terebella; shell univalve, tubular, straight, or slightly curved, with cavity undivided, and open at both ends.

D. entalis,—Shell about an inch and a half long, and two lines in diameter; at the broader end smooth, glossy, pervious, and tapering to a small point, slightly curved. Plate 55. Fig. 13. Inhabits Britain, France, India, and Persia.

Fifteen species have been discovered of this genus, and seven are inhabitants of the British seas.

Gen. 34. Serpula. *Worm-shell.*

Gen. char.—Animal a terebella; shell univalve, tubular, generally adhering to other substances; often separated internally by divisions at uncertain distances.

S. vermicularis,—Shell cylindrical, white, gradually tapering, and terminating in a fine point, and wrinkled transversely. Inhabits Britain, and is common in Europe adhering to stones, shells, and other extraneous bodies. Plate 55. Fig. 12.

Lamarck has divided this genus into the following five:

Penicillus,—Shell tubular, adhering, narrow, and rather spiral at its origin, dilating into a club form at the other end, which terminates in a convex disk, beset with small tubular perforations. See *Serpula aquaria*, Rumphius's *Conch. t.* 41. fig. 7.

Vermicularia,—Shell tubular, turned spirally at its origin, entire through its whole length, the opening simple and round. See *Serpula lumbricalis*, Lister's *Conch. t.* 578. fig. 1.

Serpula,—A tubular, adherent, calcareous tube, variously twisted or grouped, fixed to marine bodies. See ***Serpula glomerata***, Gualtieri's ***Conch***, *t.* 10. fig. T.

Siliquaria,—A tubular shell, spiral at its beg'nning, continued in an irregular form, being divided laterally through its whole length by a narrow slit. See *Serpula anguina*, Lister's *Conch. t.* 548. fig. 2.

Spirorbis,—A solid testaceous tube, regularly turned spirally, wheel-shaped, adhering to marine bodies. See *Serpula spirorbis*, Lister's *Conch. t.* 553. fig. 5.

Thirty-nine species of Serpula have been discovered, and twenty-seven are inhabitants of the British seas.

Gen. 35. Teredo. *Borer, or Ship-worm.*

Gen. char.—Animal a terebella; with two calcarcous hemispherical valves cut off before, and two lanceolate ones; shell tapering, flexous, and capable of penetrating wood.

T. navalis,—Shell brittle, thin, and flexous, tapering to a fine point; aperture orbicular; inside smooth and pervious; the smaller end is furnished within with laminae, which leave but a small opening; the anterior valves attached to the head of the animal, have a small opening, they are of a hemispheric form, somewhat projecting in front and pointed; longitudinally striated. This shell is sometimes found a foot long, and about three quarters of an inch broad at the lowest extremity, from which it tapers gradually to the summit. Plate 55. Fig. 15.

It is this shell which is so destructive to vessels, and is well known by the name of the ship-worm; this destructive creature was originally introduced by our vessels from tropical climates, but has now become an inhabitant of many of the harbours of Great Britain, and is very common in Plymouth dock. It insinuates itself into the bottoms of ships, and piles, &c. and although the oak is perfectly sound, it destroys it in a very short time. It has been erroneously imagined, that the animal perforates wood by means of its anterior valves; but there is no reason for ascribing to them such a property, as we find the mytilus rugosus, all the pholades, and donax iris, &c. can perforate both wood and stone without having such appendages.

It has been observed the teredo bores across the grain of the wood as seldom as possible, for after it gets across, it turns and continues with the grain, seldom deviating, unless it meets with another shell, or a knot in the wood, both of which it will carefully avoid, and bends its course according to the position it holds with the obstruction. In Plymouth dock, piles of wood seldom last more than five years, owing to the pernicious quality of this destructive animal. The method now adopted to preserve the timbers necessarily used about the docks, is to cover that part which is under water with short broad headed nails, which soon cover every part with a strong oxide of iron, which is said to be quite impenetrable to these animals.

Lamarck divides this genus into two, viz.

Fistulana,—Shell tubular, club-shaped, open at the smaller end, containing two valves not adhering. See *Teredo clava*, Ency. Method. Plate 167. fig. 6. to 16.

Teredo,—Shell tubular, cylindrical, open at both ends; the cover furnished with two lozenge-shaped valves, and the upper end with two opercula. See *Teredo navalis*, Plate 55. Fig. 15.

Only four species of Teredo have been discovered, one of which, the teredo navalis, inhabits Great Britain, but it is supposed to have been introduced from foreign climates.

We have rejected the genus *Sabella*, as unworthy a place amongst the testacea, the animals having only for their coverings particles of sand agglutinated on the external membrane, and resemble rather the *larvae* of insects than testaceous coverings; they may be therefore fairly expunged from the collection of the conchologist.

Of the Formation of Shells.

Having illustrated the Linnæan genera, and those of Lamarck, we will now proceed to consider the formation of shells, and the growth of the animals inhabiting them. As we before observed; the coverings of testaceous animals are composed of carbonate of lime, with a small proportion of animal matter. From the best experiments which have been made, it seems clearly proved that the shell is formed by the secretion of a peculiar fluid from certain pores on the surface of the bodies of the animals, which hardens and becomes solid. Some shells are viviparous, as is the case with the greater number of bivalves, and a few of the univalves, but the greater proportion of the latter are oviparous. From the various experiments made by Reaumur, he concludes that the shell is the last formed, that is, after the animal; and if the eggs of testaceous animals are opened, the exterior parts of the embryo are found already developed, without the least appearance of shell. But at whatever time the shell is really formed, we will not pretend to determine; but it is a known fact, that the animal is furnished with it at the time it emerges from the egg. In those bivalves which are viviparous, the shell of the young animal is formed before it leaves the parent shell; we have particularly observed this in the tellina cornea, and have found, on dissecting the animal, no fewer than eight young ones fully formed, with a shell on each. It is well known that the greater number of animals inhabiting shells never change their covering, but add to it periodically, proceeding step by step as the animal increases in size, till it arrives at a state of full maturity, when it completes its covering.

There are two different ways in which a body may increase in volume. First, The particles of which it is composed pass through the body by means of circulation, and undergo certain chemical changes, which prepare them to form a part of that body. Or, secondly, The particles of which a body is composed, may unite with it by juxta position, without having been previously circulated or prepared within that body. It is in the manner first described, or what is termed *intus-susception*, or a circulation through the body itself, that the growth of vegetables and animals is accomplished, and by the second mode, that an increase in the bulk of shells is produced; the first is the law of increase in organised bodies, and the latter that of inorganic matter. Reaumur made various experiments, which all tended to prove, that it was upon the latter mode the increase of shelly matter depended. These experiments were made not only on sea shells, but also on land and fresh water testacea. In his experiments on marine and river shells, he put them into boxes pierced with small holes, and sunk them to the bottom of the sea and rivers, which enabled him to watch the progress of the growth of the shells, by frequently drawing them up for that purpose. He first observed, that when the animal began to grow so large that part of it could not be covered by the shell, and of course remained naked or unprotected, this part of the animal must always be towards the opening of the shell, because the shell being previously completely filled, it cannot extend in any other direction. All animals inhabiting spiral univalve shells, can only extend at the head, or towards the aperture of the shell; whereas bivalve shells enlarge in their whole circumference, excepting in that part nearest the hinge. By the following mechanism, this increase takes place, according to Reaumur.

It is a necessary effect of the laws of motion, when liquids run in canals, that the small particles of these fluids, or the minute foreign bodies mixed with them, which, on account of their figure, or their less degree of solidity in proportion to their surface, move slower than the others, fly off from the centre of motion, and approach towards the sides of these canals. It even frequently happens that these small particles attach themselves to the internal surface of these canals or tubes, and form concretions of different degrees of thickness. It is also certain, that the fluids which circulate in these tubes press against their sides on every point of their interior surface; so that if they were pierced with a number of small holes of sufficient diameter to give passage to the small particles of matter floating in these fluids, these particles would be deposited on the external surface, where a crust would be formed similar to that in the inside, with this difference that it would become thicker and more solid, being less exposed to the friction of the fluid than that which is deposited in the interior of the tube.

To a process similar to the above, Reaumur ascribes the growth of shells. The external surface of that part of the body of the animal which has extended beyond the limits of the old shell, is furnished with a great number of canals, in which circulate the necessary fluids for the nutrition of the animal. A great many small particles of a viscid and earthy matter are mixed with these fluids. Now as these particles are less fluid than those of which the liquids themselves are composed, they approach the sides of the vessels, which are themselves furnished, on that side of the external surface of the body of the animal, with a great number of pores which allow them to escape from the vessels, so that they are deposited on the external surface of these tubes, or rather on that of the body of the animal itself which is uncovered by the shell.

These particles of earthy and viscid matter having reached the surface of the body of the animal, readily unite with each other, and with the extremity of the old shell, especially when the excess of moisture is dissipated; and thus by their union they compose a small solid body, which is the first layer of the new addition. This process is continued till a sufficient number of layers is formed, and the shell has acquired sufficient consistence and thickness.

It has been observed, that when a *helix* or snail is about to enlarge its shell, it attaches itself to a wall or tree, and protrudes its body a little way beyond the aperture, and the unprotected part is soon covered with the fluids which are excreted from its surface, the pellicle soon dries, and is for some time in an elastic state, but gradually becomes of a solid consistence, similar to the old part of the shell. It is truly surprising how soon a breach is in this way repaired; we have known a snail shell, with a piece broken out of it, to be renewed and perfectly hard in two days; and it is said that the new piece is equally thick with the old shell in ten or twelve days.

To ascertain whether the increase of shell did really proceed from the inside, Reaumur made a very considerable hole in the shell of a snail about half way between the apex and base, and introduced a piece of very fine skin between the body of the animal and the shell; this he glued to the internal surface of the shell, so that it completely shut up the artificial perforation: he found that the new testaceous matter was formed on the internal surface of the piece of skin, and that no calcareous process whatever was attached to the outside; which proves in the most satisfactory manner that the growth of the shell proceeds from the surface of the animal. Various other experiments have been made, not only by Reaumur, but also by other celebrated naturalists, all of which were attended with the same results.

All shells, whether multivalve, bivalve, or univalve, are composed of different layers of calcareous and animal matter; this may be easily proved by exposing them to the action of the fire, and when the animal matter is destroyed they will begin to separate into different layers.

According to the opinion of Klein, shells are increased in bulk by intus-susception; and he maintains that the animals of univalve shells are attached to the internal surface of the tip of the spire, and that from this point of union proceeds a kind of circulation from the animal through the shell; and it is upon this connexion alone that an increase can take place, and indeed upon which the life of the animal also depends. But it is well known that the animal is entirely detached from its shell in all species of univalve shells; we have seen numberless instances of the tip of the buccinum undatum, and murex antiquus, and other species of spiral shells, being broken off, and the animal in perfect health; and in some cases it must have taken place at a very remote period, as we found species of lepas and sometimes serpula growing upon and covering the broken apex. And this want of connexion can easily be observed, by putting a live specimen of the Helix succinea, (a river species, of a bright amber-colour and very transparent, the animal of which is black,) into a glass of water; when the animal begins to move, it withdraws the point of its body next the apex of the shell from its place, and it makes it fill the whole upper part when it retreats within its shell; the same may be observed in the Helix nitens, a depressed and pellucid land shell. From these circumstances, there is not the slightest doubt, but the formation must depend on principles totally different from the hypothesis of Klein.

From the mode of growth in shells, it may well be conceived how different they are in their young and adult state, particularly univalves; and they vary exceedingly both in form and colour. From these circumstances, shells in different stages of growth have not only been described as different species, but actually placed in different genera. Many species of Cypraea, in a young state, have every appearance of a Bulla or Voluta, the thick denticulated outer lip being the last part of the shell which is formed. The young of the Strombus are not only destitute of the broad expanded outer lip, but also of the claws which only are formed when the shell is mature. The Strombus pes pelicani, in its young state, is often mistaken for a spiral Murex; the Strombus Accinctus, and Luhuanus, are often placed as Cones, while the young of the Strombus gigas has long retained its place as a distinct species under the name of Lucifer, and is often to be met with in collections as a Murex. Numerous examples of this kind might be adduced, but these are sufficient to point out to the student and collector the advantage of procuring specimens in every stage of growth. Besides the alterations above mentioned, many spiral shells have an obtuse globular knob on their apex, often ex-

Formation.

ceeding in size the whorl beneath it; which, when the shell developes, entirely disappears; for example, the young of Murex antiquus has been by some authors considered a distinct species, and has been inserted in some British works as M. decollatus. Another alteration to be attended to is the finishing of the outer and pillar lips of some species, which is the last part of the animal's labour, and in many instances gives the shell a very different character. In most species of Strombus and many of Buccinum, Murex, and Nerita, there is a thick layer of calcareous matter put on the columella, extending over the whole of the pillar lip, and in some instances reaching half across the body, and even extending sometimes a considerable way up the spire in front; this process entirely conceals the beautiful markings beneath, and often the knobs and spines of some shells. This is well illustrated in the Strombus Auris Dianæ.

The processes of the formation of shells may be easily and distinctly traced in all the shells of the land Helices or snails. In the early part of the season, all the young shells will be found, with unfinished outer lips; and by examining the edge, which is in general very thin, membranaceous, and brittle, and if very recently formed quite soft and elastic, there can be no difficulty whatever in ascertaining the young from the adult shells of this tribe, as the want of the reflected or rounded outer lip, which all finished shells of the snail kind have, is the best possible criterion. But in other spiral shells, such as the Murex and Buccinum, there is often much difficulty; particularly in those with spines; as the spines are in general formed by particular parts of the animal admirably adapted for that purpose, on the edge of the outer lip; so that every addition has the appearance of being complete; and without knowing the particular number of convolutions, there is no certainty whether or not the shell is finished.

Of the formation of Spines, Ribs, and other Protuberances.

The spines, and other irregular protuberances, with which some shells are furnished, such as the Murex haustellum, and Ramosus, with many others, are produced by particular organs adapted to that purpose; and are always formed by the successive enlargement of the shell, and uniformly on the margin of the outer lip; the lengthened spines are produced by fringed appendages, or cylindrical organs; they are all hollow and tubular, and are closed at their outer edges. The beak of the Murex and Buccinum is in like manner formed by a long cylindrical organ, which is supposed to be a feeler, is capable of extension and contraction, and is used occasionally by the animal to attach itself to solid bodies, as is the case with spines. In bivalve shells, which present a grooved and ribbed appearance, the whole anterior surface of the animal is grooved and channelled in the same way; and from thi the shell derives its structure. The diversity of structure of the grooves, striae, scales, and spines, and of the various excavations accompanying them, may be accounted for by the diversity of structure of the different organs of the animals inhabiting them. Those spines and knobs which rise immediately from the varices, or ribs, are produced by particular organs which surround the extremity of the neck, and stretch out from every part of its circumference. This circumstance also goes to prove, that the shells are increased in size by successive and regular enlargements of the animal. Ribs are composed of elevations arranged parallel to the axis of the shell, and sometimes slightly oblique; they appear to be formed by successive additions to the outer lip. In those bivalve shells grooved on the internal surface of the anterior margin, it may be observed, that owing to the progress of the growth of the animal, that part of the body which presents a smooth equal surface has advanced, and nearly filled the whole of the shell; and the testaceous matter secreted from this part of the body being deposited on the grooves, channels, or striae, which were formed when the anterior part of the body occupied that part of the shell, fills them up completely, and leaves the surface quite smooth and polished. New additions being made to the shell as the growth of the animal requires it, the smooth surface of the body advances forward, and fills up with its secretions what is now grooved; while the new part of the shell, which corresponds to that part of the body which has an unequal surface, only presents this appearance. In this way ribs or grooves, in some species of Ostrea, Cardium, and Spondylus, are formed.

But the most difficult thing occuring in the shape of ribs, to account for, is the ribs of *Cardium costatum*. The ribs of this species are very high and keeled, and at the same time hollow. This shell is about four inches long, and nearly the same breadth, with eighteen high sharp-edged ribs, grooved or hollow in the inside from the apex to the base. The only way in which we can account for the formation of these hollow triangular ribs is to suppose that the margin of the anterior part of the animal is deeply channelled or grooved; and when this part of the body is in contact with the recent shell, the tips or elevations are formed, and are then open to the internal surface of the shell, but the posterior part of the body being hard and smooth never comes in contact with the excavated parts of the ribs. On the contrary, as the testaceous matter is excreted from this part of the body, it is deposited on that part of the internal surface of the shell which it touches, stretches across the deep grooves, and forms the third and interior side of the triangular ribs.

All univalve shells with a regular spire may be referred to four distinct classes with regard to their form, namely, those having a disc, cylindrical shells, turbinated, and ovoid shells: At the same time, we are aware that these forms are subject to several modifications, and they depend on the manner in which the convolutions are applied to the common axis. If we can suppose, that, from the first production of these animals, when they began to be developed, the fibres of one part of the body, such as those of the external surface, are longer than those of the opposite surface, consequently the body of the animal, continuing to increase according to the original tendency, will assume a spiral or curved form.

The formation of the umbilicus depends also on the plane on which the animal has formed the spire of its shell. If the plane of the spiral convolutions has been directed round a conical or elliptical axis, and each whorl has become more or less distant towards the centre of the shell from this hollow point, a shell may be thus formed whose umbilicus will be more or less open, according to the greater or less degree of separation which the animal must give to the turnings of the spire, corresponding to its structure. An opposite effect will be produced, if the convolutions turn round an axis so small that they will be permitted to come in contact with each other. In this case no umbilicus will be formed.

Of the Formation of Pearls.

It appears, from every observation which has been made, that the pearls found in the different species of pearlaceous bivalves, are formed by the same secretion which produces the shell itself; and this is rendered very probable by all shells composed of mother-of-pearl occasionally producing pearls. Two different opinions have been entertained with regard to the cause of the production of pearls. The one, that they are merely morbid concretions; and the other, that they are owing to wounds or some other external injury, or from insects making perforations in the shells. It is not improbable that they may be formed in both ways.

Various methods have been adopted to produce pearls by artificial means. In China, and many other parts in the east, the shells of the *Mytilus Margaritiferus*, or great mother-of-pearl muscle, are perforated by means of a drill, and a piece of brass wire introduced, rivetted on the outside like a nail; the shell is then introduced into the sea, and it often happens that large and well formed pearls are found on the wire in the inside. Another mode is adopted, which also sometimes proves successful. The shell is opened with great care, to avoid injuring the animal, and a small portion of the internal surface of the shell is scraped off. In its place is inserted a small spherical piece of mother-of-pearl, about the size of a small partridge shot. On this the animal forms a pearl, while it serves as a nucleus. This is a Finland experiment. It is said that Linnaeus made a remarkable discovery respecting the generation of pearls. The experiments were made on the Mya Margaritifera, or fresh water muscle. It is said it was from this discovery he was raised to the dignity of nobility. But we are not acquainted with the way in which he performed this operation.

Of the Colours of Shells.

The great diversity, brilliancy, and elegant arrangement of the colours of shells, have rendered them objects of high estimation in almost all ages, and cannot fail to arrest the attention of every common observer; and whether we regard them for their intensely vivid colouring, or the extreme elegance of their forms, they must certainly be allowed to be one of the most beautiful departments of natural history; and what has at all times been

Of Colour.

their particular recommendation, to collectors of natural objects, is, that it requires no care to preserve them; for when properly cleaned, and placed in a cabinet, they may last for ages.

There is no problem in natural history more difficult to explain in a satisfactory manner than the colouring of shells; we shall state what appears to us most satisfactory on this head: at the same time we confess there are still many important points which to us are inexplicable.

Land shells, particularly those of the Helix nemoralis, or common girdled snail, are subject to infinite variety of colour. The ground colours are either white, citron, yellow, flesh-colour, olive, and are indeed subject to endless modifications of these with different other colours; sometimes with bands, from one to six in number, running spirally from the apex of the shell, gradually increasing in breadth as they descend; these bands are either dark umber-brown, orange-coloured brown, or chesnut brown; and some varieties are without bands.

As was formerly observed, according to Reaumur's ideas, the shelly matter is secreted from organs on the surface of the animal's body. But in certain places of the surface, the particles, which produce different colours are separated, and no doubt from particular organs suited to the purpose; we cannot suppose, that the difference of the nature or figure of the particles can produce any particular figure, as we are not aware that colours are subject to assume peculiar forms. From the experiments of Reaumur, it appears almost certain, that the colouring matter proceeds from the glandular structure of the neck, and can be distinctly traced in the Helix nemoralis. Its body is whitish, excepting towards the neck; where the white inclines to yellow, citron, or flesh-colour, and where, besides, there is a number of black or brown spots, equal in number to those on the shell, and arranged in the same direction and order. The existence, therefore, of these excretory organs can no longer be doubted; and as the stripes, or other markings on shells, enlarge as the shell increases in size, this must proceed from the enlargement of these organs with the growth of the animal. On this principle may be accounted for all that variety of configuration in the colours of shells, by supposing organs of all these different forms to be placed on the neck of the animal; according to this theory, all the inner surface of the shell, even those which are coloured in the inside must be white, or at least partaking of that colour, secreted by the vessels of the body, with the exception of the part which can be reached by the neck of the animal when it returns within its shell.

In that beautiful division of shells termed *porcellaneous*, on account of their compact nature and beautiful enamelled surface, a different process is necessary for the formation of colour and markings; and the animals inhabiting them are furnished with a membrane perfectly different in its construction from those of the animals of other shells. In this department the colouring matter is deposited in two different ways, and at different periods. In the formation of the shell itself, the ground colour is produced from the external glands, in the manner in which the shells of the Helix nemoralis, and indeed all other testacea, are formed, as above described. On the external surface of this another layer is formed, and usually variegated, either with zig-zag markings, or stripes of different colours, which completely conceal the original layer. Over this a third layer is formed, generally darker than that below, which, in its turn, obscures in a great measure the second coating. This finishing is said to be performed by two soft membranaceous wings, which, being protruded from each side of the opening of the shell, cover its whole surface: The longitudinal line, which is to be seen in the Cypraea tigris, Arabica, Exanthema, and other species, is supposed to be formed by the junction of the two wings, where a smaller quantity of colouring matter has been deposited; but what is most difficult to account for, is the formation of the second or middle layer; for if we begin by examining a young shell of the Cypraea Exanthema, we shall find that the inside is a dark purple, and the outside is covered with transverse, alternate, interrupted bands of brown and lead colour, with irregular white spots and eyes. The young of the Cypraea tigris is bluish white in the inside; the outside is brown, with two or three paler bands. The young Cypraea Arabica is bluish white in the inside, with a deep purple outside, with two or three paler bands of brown. Now, if the centre coats of these shells are formed by the wings of the animal, it must either have the power of excreting at pleasure different colours from the glandular surface of these wings, or the glands must not only be changed in form, but also in arrangement, at different periods of the growth of the shell. And it is difficult to suppose, that a total change of the power of the wings can be effected, because such a change would be necessary whenever a new shell is formed, as it is pretty evident that all the Cypraea at least change their shell at different periods, or, in short, when the shell is too small to contain the animal. A little attention to the formation of the shell of this tribe will satisfy any person that it cannot be increased in size after it has been completely finished; indeed, we have in our possession shells of the same species, of all sizes, both in the finished and unfinished state,

Of Collecting, &c.

However satisfactory the experiments of Reaumur may appear, we are of opinion, that the animals of many shells have the power of arranging the colours, and forming different layers of shelly matter, with which we are as yet totally unacquainted. The *Voluta Oliva*, and all the species corresponding with it in form, have four distinct layers of testaceous matter. The Voluta Erythrastoma has in the inside a layer of orange, above that a layer of white, then a layer of purple, and a layer of white again, with zig-zag markings of yellowish brown, blackish brown, and purple; much depends also on the exposure of the shells to the light. In same species of bivalves, of the Spondylus and Ostrea, the valve on which the shells rest, or what is termed the under valves, are often colourless, or at least much paler than the upper valve; and it will be observed, that these shells which bury themselves in the sand, or in rocks, such as some species of Mactra, all the Pholas, with some of the Mytilus, are totally colourless, or of a dingy white.

Methods of Collecting, and Cleaning Shells.

Shells are found over the whole surface of the globe. A numerous tribe of these inhabit the land, and abound most in warm climates, they are also found plentifully in fresh water, though the species are not so numerous as land shells; but the greatest variety is to be found in the ocean. Land shells are to be met with most plentifully after a shower, or early in the morning. Fresh water shells should be sought after in dry summer weather, when the streams are clear in ditches. A spoon, made of tin plate, and perforated with small holes, should be used for raking along the bottom; and in rivers and lakes a dredge should be used, with a bag of coarse linen or woollen cloth. The marine shells are to be found on sandy beaches, after storms, or are to be taken into the dredge. Those who wish to obtain minute species, must have a dredge made for the purpose, with very fine meshes. When shells are found with the animal in them, they should be put into a basin and hot water poured on them, when the animals may easily be extracted without injuring the shells.

In the cleaning of shells, the less art that is made use of the better. When they are incrusted on their outer surface with extraneous matter, a knife, or an engraving tool may be used for starting it off; and when all is removed, they should be washed over with diluted muriatic acid, to remove what remains of the calcareous substances with which they are incrusted; it must only be kept on for a short time, for fear of destroying the colours of the shells: It should be plunged in water frequently, and the acid reapplied till it is clean. When dry, a white chalky appearance often remains, which can easily be removed by rubbing the shell with Florence oil, which restores the colouring, and at the same time prevents the acid from acting upon the shell. Gum-water is sometimes used, but this gives the shell an unnatural gloss, and requires to be often repeated, as it becomes all different shades if touched by a damp hand.

Great deception is often practised by dealers in shells, by which their natural appearance is changed. If a shell happen to have the lip broken, they file it smooth, and form a canal, or other part, to imitate rare shells; striæ and even the colouring are also counterfeited; and the whole finished with a coat of varnish. This practice is carried to a great height in Holland; and indeed we have in our possession a specimen of *Cypræa Arabica*, so completely altered, that it requires close investigation to ascertain what it originally was, for it has every appearance of a new shell. The way in which this shell is transformed is as follows. A strong solution of muriatic acid is applied to the whole upper surface, which soon corrodes the beautiful brown Arabic-like markings, and leaves the whole of a purple colour. A red hot iron is then applied, which burns the purple, and changes it to a fine burnt-umber brown; the muriatic acid is again applied in spots over the surface, allowed to remain on till it eats through the brown produced by the burning, and gets down to the white, and of course a white spot is produced wherever the acid

Collecting.

has acted : The shell is then carefully washed and polished with tripoly and leather. till its whole surface has a fine gloss.

Many shells are very beautiful when the epidermis is removed; but this often proves a difficult task, and fine shells have been destroyed in the operation. It may be done with perfect safety to the shell by a very ingenious and simple process, discovered by Mr Nicol, Lecturer on Natural Philosophy. The shell from which the epidermis is to be removed is put into a vessel with lime and water, and boiled for some hours, and when taken out washed over with muriatic or nitric acid, and immediately plunged into water, when the epidermis can be easily rubbed off with the finger or a brush. Some shells, as the common muscle, require three hours boiling, but others, as Mya Margaritifera, require from twelve to fourteen hours.

When shells are perforated by sea-worms, or when any other accidental injury occurs to deform a good specimen it is certainly desirable to improve it, and for this purpose a putty may be made of fine whitening, flour, and glue; the holes or cracks may be filled up with this composition, and allowed to dry. The parts thus mended may be coloured with common water-colours, and then brushed, and afterwards rubbed over with Florence oil, or a little weak gum-water.

Great caution is necessary in extracting the animals from shells with a fine enamelled surface, for, if the water is used too hot, the polished surface often cracks in a thousand directions.

The most simple method of arranging a cabinet is, to make boxes of cards, by cutting out a small piece of about a quarter of an inch square, and then folding up the sides. On the bottom of each box should be written the specific name, where found, with a reference to some author, and any other observations which may appear necessary.

Plates.

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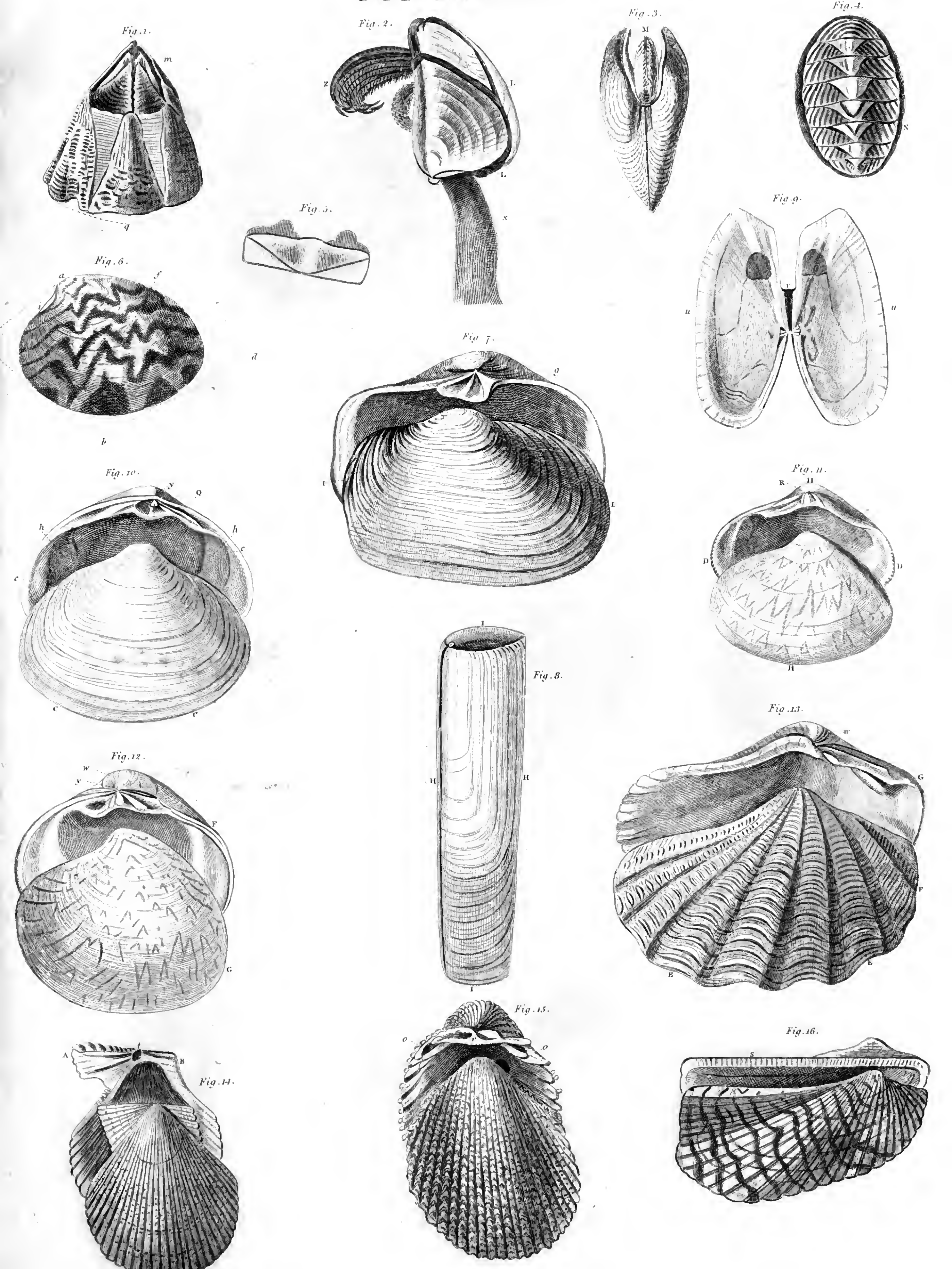
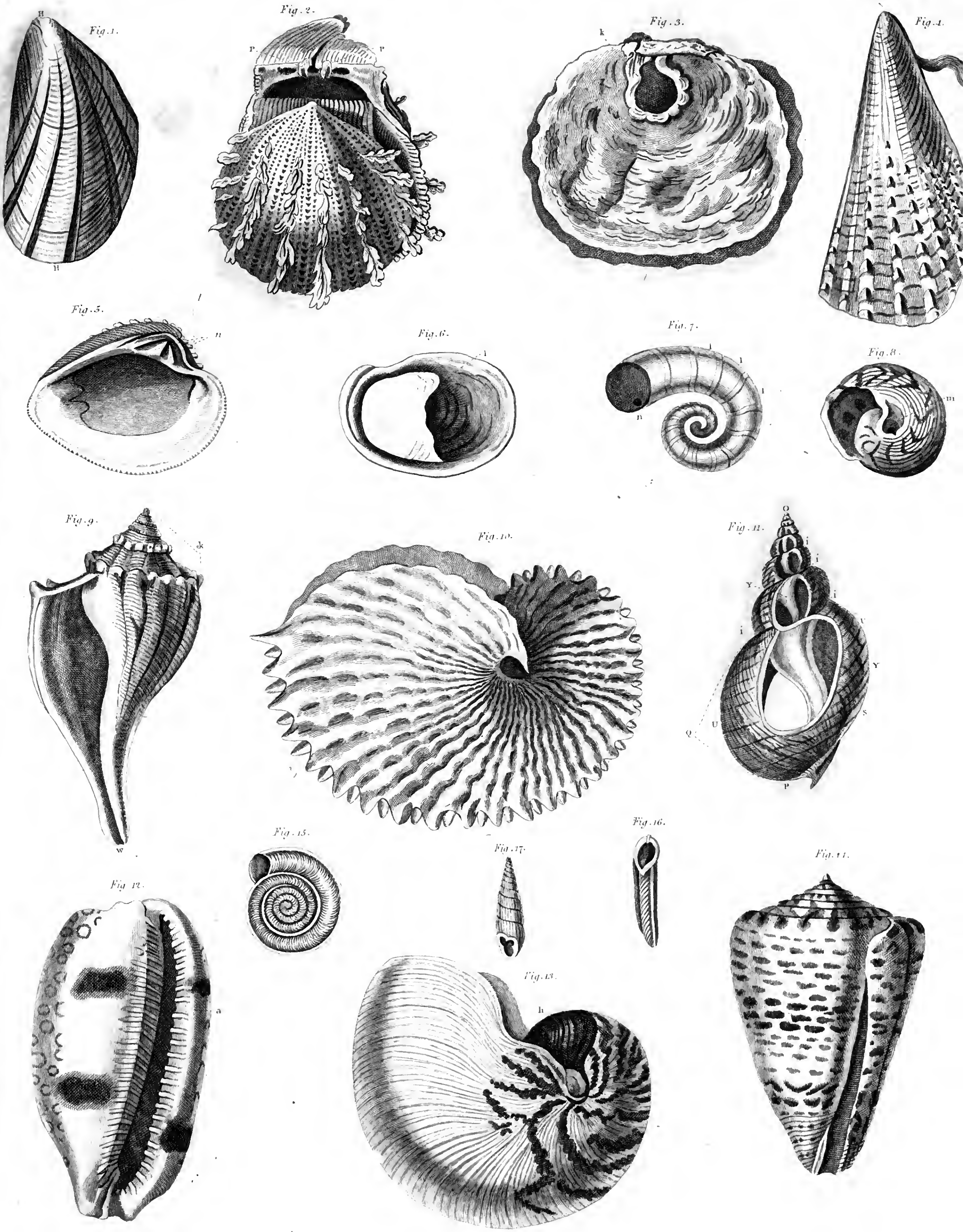
CONCHOLOGY.

PLATE 53.



CONCHOLOGY.

PLATE 5



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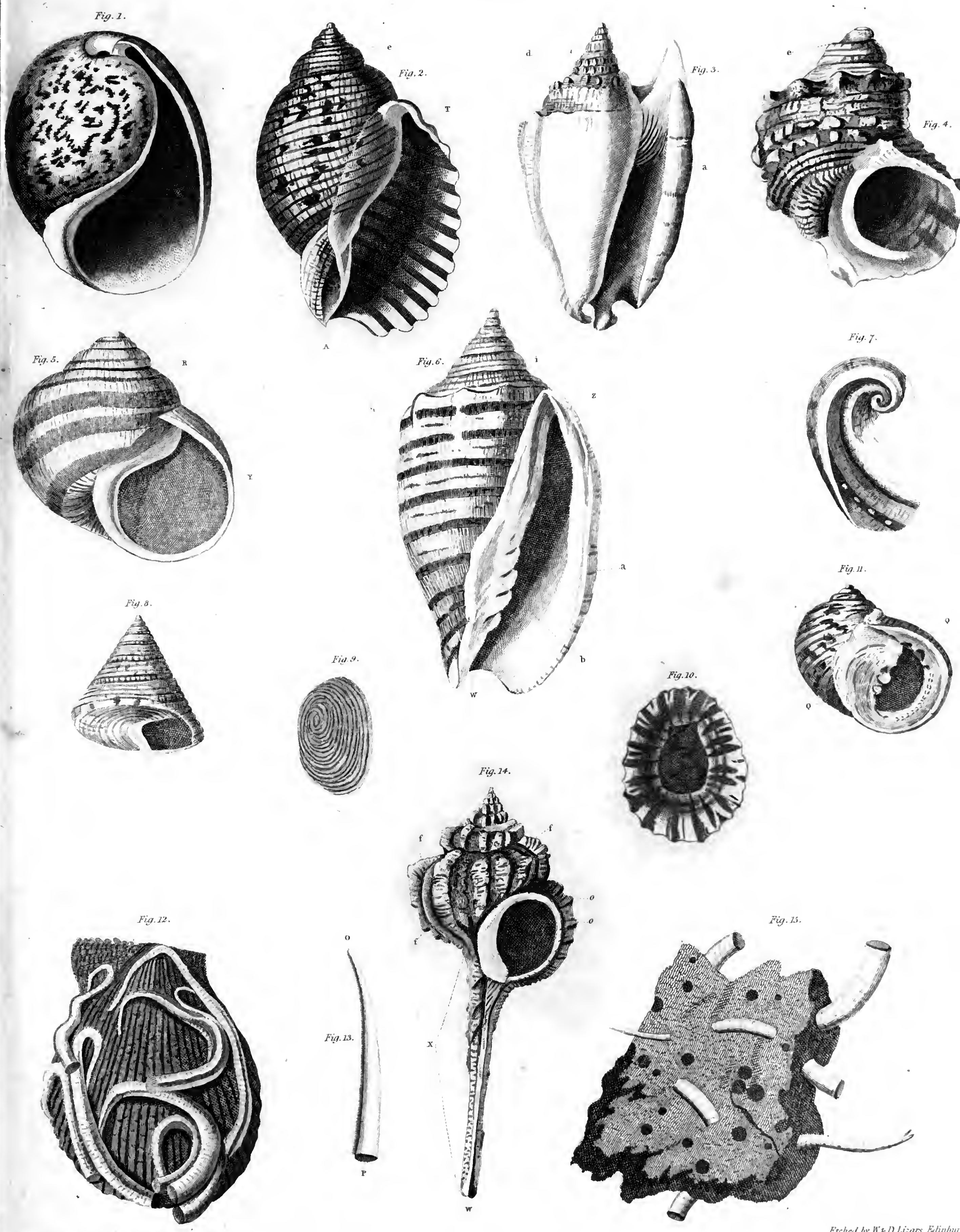
CONCHOLOGY



Drawn by Capt.n Brown, for the Encyclopædia Edinensis.

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CONCLAVE, an assembly or meeting of cardinals of the Romish church, shut up for the election of a pope. This mode of election began in the year 1271, when the cardinals had spent nearly three years in providing a successor to Clement IV. who died at Viterbo, and, not being able to come to a conclusion, were on the point of breaking up. The magistrates of Viterbo interfered, shut the gates of their city, and confined the cardinals to the pontifical palace till the business was settled; and the same mode of proceeding has been followed since that time. When the election takes place at Rome, the conclave is held in the hall of the Vatican, which is fitted up with cells or stalls, ten feet square, wainscoated, numbered, and drawn for by lot, after which each cardinal affixes his arms to the cell which falls to his share. The conclave is strictly guarded by troops, to prevent all communication or undue influence with the electors. When the assembly has continued sitting three days, the regulation is, to allow only one dish for a meal, and after 15 days more the electors are limited to bread, wine, and water.

CONCORD, a term in grammar, denoting that part of syntax or construction by which the words of a sentence agree among themselves, that is, nouns are put in the same case, number, and gender, and verbs in the same number and person with nouns and pronouns.

CONCORD, a term in music, denoting the relation of two sounds, which are always agreeable to the ear, whether they are heard in succession or consonance. Concord is opposed to discord, which latter is applied to such sounds as have no pleasing, or rather produce a disagreeable effect.

CONCORDANCE, a dictionary or index to the Bible, in which the leading words are alphabetically arranged, that the places in which they are being referred to, the reader may be enabled to find out the passages, and compare the several significations of the same word. Various works of this kind have been compiled, of which a Hebrew concordance, in two volumes *folio*, and adapted to the English Bible, was published by Dr Taylor in 1754; a Hebrew, Latin, and Greek concordance, in four volumes folio, was printed at Rome in 1621, and several concordances adapted to the English Bible have appeared. The largest and most elaborate English concordance was compiled by Alexander Cruden, in one volume 4to.

CONCORDAT, a term in the canon law, denoting a covenant or agreement, concerning beneficiary matters. as a resignation or promotion; but of such a limited nature as not to be obligatory without being confirmed by the pope. The same term is applied to the covenant entered into at Bologna in 1516, between Leo X. and Francis I. of France, for regulating the mode of nominating to benefices; and the German concordat, made between the emperor Frederick III. and the princes of Germany in 1448, refers to matters of the same kind.

CONDAMINE, Charles Maria de La, a celebrated French philosopher, was born at Paris in the year 1701, distinguished himself in early life by his courage and skill in military affairs; and having quitted the profession of arms, he indulged his taste for travelling, by visiting the shores of the Mediterranean, and some parts of Lesser Asia, Egypt, and Turkey. Soon after his admission into the academy of Sciences, he projected a voyage to the equator, for the purpose of measuring a degree of the meridian; and in 1736 he accompanied the other mathematicians to Peru, where he exhibited great assiduity in the accomplishment of their mission. On his return to Europe, he descended the celebrated river of the Amazons; and in that arduous enterprize was exposed to innumerable privations, and incredible hardships. In 1745 he published an account of his travels in South America, and in 1751 a journal of the voyage.

After a short residence in his native country, Condamine visited Italy; and, in 1762, published remarks and observations on the interesting objects which had presented themselves during his tour in that country. A visit to England made him acquainted with the method of inoculating for the small pox; and when he returned to France, he strongly recommended the practice to his countrymen, in memoirs and letters which he published on the subject. During the latter years of his life, he was afflicted with a paralytic disorder of the extremities, which rendered him unfit for serious study, and led him to amuse himself with poetical compositions and translations. He died in 1774, when he had reached the 73d year of his age. His acquisitions, it has been said, were more extensive than profound, and he possessed rather an ardour for making researches on a variety of subjects than patience completely to investigate any. But his compositions were drawn up in an easy, simple, and elegant style.

CONDENSATION, a term applied to that change in the condition of bodies by which their particles are brought into closer contact, whether by mechanical compression, or by chemical action. Solids and elastic fluids undergo condensation by compression; and all bodies become denser by the abstraction of caloric, as they are expanded by combining with heat. See Chemistry.

CONDENSER, a pneumatic apparatus, by which a greater quantity of air may be accumulated than the natural state of the atmosphere, and also an electrical apparatus for the accumulation of electricity.

CONDILLAC, Stephen Bonnet De, an eminent French philosopher, of whose early history no record is preserved, or generally known. An "Essay on the origin of Human Knowledge," which appeared in two volumes, in 1746. first brought him into notice, and acquired for him no small degree of reputation. His object in that work is to develope the faculties of the mind, by a kind of historical detail of its different functions. In 1754 he published a "Treatise on Sensations," in two volumes. In this treatise he considers what would be the conceptions of a statue, furnished at once with a single sense, and successively with the other inlets to the knowledge of external objects, and in this way he attempts to account for the origin of memory, judgment, and the other mental faculties. In the succeeding year he published a "Treatise on Animals," the object of which is, to refute the opinions of Descartes and Buffon concerning the mechanical nature of brutes, and to shew in what manner their faculties are acquired.

The celebrity of the writings of Condillac, it is supposed, procured for him the distinguished situation

Condorcet.

of preceptor to the prince of Parma; and, for his instruction, he prepared a "Course of study," which was published in 1776, in 16 volumes 12mo. The introduction to this work is devoted to the different modes of communicating instruction, and he gives the preference to the progressive advance from particular facts to general principles. The earlier parts of the course of study are destined to metaphysical lectures, logic, and the philosophy of the human mind, from which he proceeds to the study of history, of which an ample and well arranged abridgement is given in 11 volumes; and a volume, consisting chiefly of political reflections, is added as an appendix. A small work on commerce and government, considered relatively to each other, is the production of the same author.

Condillac died in 1780. In all his works he exhibits an extensive knowledge of the subject which he discusses; and he was not less distinguished by the soundness of his judgment, than by the clearness and comprehension of his views, in almost every branch of literature.

CONDORCET, Jean Antoine Nicolas de Caritat, Marquis de, a profound mathematician, and an active promoter of the French revolution, was born at Ribemont, in Picardy, 1743. He was educated at the college of Navarre, where the ardour of his application in the study of mathematics gave the first presage of his future eminence in that department of science,---a promise which he redeemed, in some measure, before he had passed the 22d year of his age, by the publication of his *Treatise on the Integral Calculus;* a work which was praised by D'Alembert and Bossut. His next work was *Essays on Analysis*, in four parts, which related chiefly to the system of the world. In 1769 he was admitted into the academy of sciences, first as joint mechanician, and next year as an associate, where his friendship with D'Alembert commenced, and continued till his death. While employed along with D'Alembert and Bossut, in financial calculations, he published a reply to Necker's essay on the corn laws; and a defence of the political sect to which he had become a partisan,—a work in which, together with another soon after given to the public under the title of Commentaire des pensées de Pascal, he avows his infidelity, and treats the ministers of religion with illiberal abuse.

In 1773 he published the lives of the academicians who had died between the years 1666 and 1699. The *Eloges* of Huygens, Picard, and Roemer, omitted both by Fontenelle and D'Alembert, are inserted in this work, which procured its author the secretaryship of the academy. On the death of Saurin in 1782, Bailly, the author of the history of astronomy, and Condorcet, now also distinguished by his writings, were candidates for the vacant place in the French academy; by the casting vote of M. de Tressan, Condorcet was successful, to the no small disappointment of his rival, who had on a former occasion lost his election. His discourse on admission related to the rapid progress of knowledge during the 16th century, and to the now exploded doctrine of the infinite perfectibility of the human mind, and is said to have come short of the expectations of his friends.

As secretary of the academy of Sciences, an office in which he was at first associated with D'Alembert, he distinguished himself by the elegance and discrimination of the accounts which he wrote of the lives of his predecessor in office, of Euler, Turgot, Voltaire, Franklin, and other celebrated men. Yet his biographical performances seem to have given little interruption to his mathematical pursuits, for with some of the former his *Memoirs on the Calculation of Probabilities* were contemporary, and he was employed with Sejour and La Place in estimating the population of France, the result of which was published first separately, and afterwards in the memoirs of the Academy. He also contributed largely to the mathematical department of the *Encyclopedie*, in which his articles are distinguished by the signature M.D.C.

Cordorcet.

But during a great part of his life he was fully as much immersed in political as in scientific or literary pursuits, and had an active hand in the formation of the schemes, and of course in the promotion of the events, which preceded or accompanied the French revolution. He conducted a work, entitled *La Bibliotheque de l'Homme public*, containing analyses of political writers, and a news-paper called *La Chronique de Paris*, replete with declamation against royal prerogative. On the flight of the king to Varennes, he joined himself to Brissot and Thomas Paine, aided by whom he published the periodical paper termed the *Republican*, which was filled with atheistical and antisocial jargon. He was also an active member of the Jacobin club, and, on the dissolution of the constituent assembly, was chosen one of the representatives for Paris. As a member of the Brissotine faction, he drew up a *Plan of public instruction*, the *manifesto* addressed by the people of France to the powers of Europe on the commencement of the revolutionary war, and *a letter of expostulation to the king*, in which he insulted his sovereign. After the king's death, he was employed by the Girondists to frame a new constitution, an attempt at legislation which obtained the approbation of the Convention, but which was in reality a tissue of impracticable absurdities.

The ascendant tyranny of the bloody Robespierre compelled Condorcet to seek for safety by concealment for more than nine months within the precincts of Paris, and afterwards, as he dreaded a domiciliary visit, he retired to the woods, where, after being nearly exhausted by hunger and fatigue, he was seized by a municipal officer, and thrown into a dungeon with the view of being conveyed next day to Paris; but in the interval he swallowed poison, which for some time before he had kept in his possession, and was found dead when visited in the morning. After his death, a volume on the *Perfectibility of the Human Mind*, and *An Elementary System of Arithmetic*, were published from his papers. He left behind him a daughter, who, in 1807, married Arthur O'Connor.

It is obvious from these notices that Condorcet's scientific and literary knowledge was extensive and accurate, and his facility of composition uncommonly great, but that his mind was warped by the metaphysical and political absurdities which, like an epidemic disease in his time and country, exerted their awful energy to the temporary subversion of every thing sacred and social, and to the inroad and far-spreading influence of anarchy and misrule.

CONDUCTORS, a term in electricity, denoting such bodies as receive and communicate electricity, and set in opposition to non-conductors, in which it is retained and accumulated. Metallic substances belong to the first class, and glass and wax belong to the second. See ELECTRICITY.

CONE, a geometrical term denoting a solid figure, which has a circle for its base, and its summit terminated in a point. See *Conic Sections* under MATHEMATICS.

CONE-SHELL. See *Conus* under CONCHOLOGY.

CONFEDERACY is a law term, which signifies a combination of two or more persons for the purpose of doing injury to another, or of committing some unlawful act.

CONFERVA, a genus of plants belonging to the Cryptogamia class.

CONFESSION, in its general acceptation, signifies a declaration or acknowledgement of some truth; but among divines it denotes the verbal acknowledgement which a Christian makes of his transgressions. In the church of Rome, confession of sins is not only recommended as a voluntary duty, but is regarded as a sacrament, or more solemn religious act, required of all its members.

CONFESSION OF FAITH is a summary of the principal articles of belief adopted by any church. The apostle's creed may be considered as the earliest confession of faith. It was composed by several fathers of the church at different periods, and was generally adopted nearly in its present form in the fourth century. The Nicene creed derives its name from the council which met at Nice, and was adopted by that assembly in the year 325. The Athanasian creed was drawn up, it is supposed, about the middle of the fifth century by Hilary, bishop of Arles, and erroneously bears the name of Athanasius, who died not long after the middle of the fourth century. The first protestant confession of faith was presented to the diet of Augsburg, and is known by the name of the Augsburg confession. The first English confession was drawn up by Archbishop Cranmer in 1551. It consisted of 42 articles, which, after a revisal in 1562, were reduced to 39. The first confession of faith in Scotland was ratified by Parliament in 1560, and the Westminster confession was drawn up in 1643, and approved by the General Assembly in 1647.

CONFUCIUS, the celebrated Chinese philosopher, was born in the kingdom of Loo, (now the province of Chan-tong,) about 550 years before the Christian era. By his mother he was nobly, and by his father he was royally descended; but he owes none of his wide spread celebrity to the honours either of a long or an illustrious line of ancestry. From childhood he was devoted to the acquisition of knowledge, and, before he had attained his fifteenth year, his mind was richly endowed with maxims of wisdom and virtue, derived from the study of the ancient books of history and morality. And so soon as he had arranged his knowledge into system, and had obtained a commanding influence among his countrymen, he endeavoured to raise them from the vices in which they wallowed. To this end he employed persuasive instructions, and exhibited a splendid pattern of piety as well as of personal and social vir tue. And though his success did not accord with his wishes or exertions for the improvement of his people; yet, by his administration of public affairs, his native kingdom Loo enjoyed such prosperity and happiness as to rouse the jealousy of some of the surrounding petty states, which with it formed constituent parts of the Chinese empire; and lest it should rise to a rank, and acquire an influence dangerous to their independance, by following the counsels of so wise and intelligent a minister, they had, it is said, recourse to a stratagem, which was suggested by the king of Tsi, to counteract the reformation of manners so happily begun, and advancing by a progress so promising. This stratagem, which, unfortunately for the cause of virtue and good government, was but too successful, was an embassy to the king of Loo, charged with a present to him and his courtiers of girls of extraordinary beauty, and highly accomplished in the arts of singing and dancing. The charms of these strangers, set off with siren songs and lascivious gestures, soon captivated the hearts of their new masters, and dissolved the court and the kingdom into a state of voluptuousness inconsistent with the study of philosophy or the practice of virtue. The prince, immersed in pleasures, abandoned the business of the kingdom, and his pernicious example was imitated by his courtiers, and soon pervaded all orders of the people, who, in the pursuit of pleasure, neglected their duties, and despised the warnings of wisdom.

Confucius, unable to stem this tide of corruption, whose surges were washing away every trace of right principle and of good feeling, resigned his employment, and went into voluntary exile. He travelled through several kingdoms, rather shunned than countenanced or encouraged; for his austere manners, and inflexible integrity, made princes and their ministers dread a man who, were he admitted as an associate, was likely to undermine their credit and authority. As he wandered from province to province in quest of minds fitted to appreciate, and pursue his maxims, he found himself reduced to a state of extreme indigence; but with a soul elevated above the changes of life and the vicissitudes of fortune, he betook himself with ardour to the instruction of all ranks and conditions of men in the duties of their respective stations, and in the worship and veneration due from them to the Tien, by whom it is not ascertained, on undoubted evidence, whether he understood a mere physical energy, or a supreme intelligent cause and preserver of all things. In his instructions, he constantly referred to the sentiments and conduct of Yao, Chun, Yu, and several other of the virtuous emperors of ancient times. These lessons of morality and religion, often reiterated and enforced by cogent motives, at length attracted general attention, and procured their author upwards of 3000 disciples, whom he divided into four distinct classes, according to their different objects and pursuits. The first class consisted of those who studied to acquire virtue; the second, of those who were endeavouring to reason with precision, and to compose with elegance;

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the third, of those who studied the rules of good government; and the fourth, of those who were engaged in the investigation of the principles of morals.

Of the three thousand followers of this philosopher, five hundred are said to have been peculiarly distinguished for their attainments in knowledge and in virtue, and for the high offices which they were honoured to sustain in the different kingdoms or tributary states of the Chinese empire; and in both these respects, seventy-two of the five hundred are also said to have risen super-eminent above their fellow disciples.

It was no part of the system of this sage to speculate or to theorize on the physical phenomena of the universe, or to dive deeply into abstract questions of belief; but his object was to inspire his followers with the sentiments of reverence, awe, and gratitude to the Lord of heaven and of earth, to whom all secrets and the thoughts of the human heart are known; and to lead them to the practice of all the social and relative duties of life, from the consideration of their being suited to the nature and condition of man, and from the beneficial consequences, both personal and social, by which their performance was followed. The great rule of conduct which he inculcated, was never to act according to the dictates of passion, but to submit implicitly, and in all things, to the suggestions of reason; and in the modesty, mildness, and general correctness of his conduct, he was in his own person a pattern of the precepts which he had imposed on his disciples with so much zeal and earnestness. He ever displayed great firmness and constancy of character, amid all the difficulties by which his life was checquered. On the death of Tcheoo, a prince by whom he had been protected, he became the subject of the songs and satires, of the mockery and the merriment, both of the mandarins and of the populace; yet he is said to have maintained his usual tranquillity; and even when a drawn sabre, wielded by an enraged adversary, was suspended over his defenceless head, he betrayed no emotion of dread, and when pressed to hasten from the scene of outrage, he replied, "If we are protected by the Tien, can the rage of Huan-tee do us any harm, notwithstanding he is president of the tribunal of the army?"

In the seventy-third year of his age, this philosopher was seized with a lethargy, in which he languished seven days, and then expired in the arms of his disciples. He was buried on the banks of the river Soo, where he had been accustomed to assemble his followers; his sepulchre is still shewn, surrounded by walls, and exhibiting the appearance of a small city. His death was deeply and universally lamented by all classes of men in the empire; his pupils in particular went into mourning, and bewailed his loss as though he had been their father.

In personal appearance, Confucius is said to have been of a stately stature, and of a grave and majestic air; his complexion olive; his eyes large; his beard long and black, and his voice strong and sharp; his forehead was deformed by a small protuberance, from which he was sometimes called the *little hill*, a name which the modesty of his nature made him frequently apply to himself. For an account of the writings of Confucius, see CHINA, under the head *Literature*. From these writings the Chinese derive their political, moral, and religious knowledge, and the name of their author is associated with almost every institution of the empire; his name is also held in the highest veneration, there being scarcely a village in the country which has not a temple or chapel sacred to his memory, called the "house of Confucius," in which sacrifices and prayers are addressed to him by all descriptions of the people, but chiefly by students previous to their public examinations, and by mandarins on their entrance on their public functions.

Congelation || Congo.

CONGELATION is that change which a fluid body undergoes when it passes to the solid state. See CHEMISTRY.

CONGER EEL. See *Muræna* under ICHTHYOLOGY.

CONGLETON, a town of Cheshire in England, contains near 5000 inhabitants, many of whom are employed in the manufacture of ribbons, gloves, and purses.

CONGO, an extensive region of Africa, washed by the waves of the Atlantic on the west, and situated between the 3d and the 8th parallels of south latitude, with Loango on the north, and Angola on the south; but its eastern boundary depending upon the state of peace and war with the conterminous tribes, was, with some of the contiguous states, first discovered, and has hitherto been held in subjection by the Portuguese. By them it was divided into six provinces; Songo, a sandy region on the seashore, bounded and traversed by streams; Bamba, an extensive, fertile, and well watered, but an uncultured district; Pemba, situated in the interior, and watered by the Lelunda, and some smaller streams; Batta, an inland and fertile province; Sundi, a mountainous district; and Pango, a fertile but ill cultivated province.

Were credit due to the quaint and romantic accounts of the Portuguese missionaries, we should in Congo contemplate a country of a mild and genial climate, shedding down its benign influences upon a portion of the globe teeming with whatever is rare and rich in mineral, vegetable, or animal productions, and inhabited by a race of men living in a well organized state of society, and familiar with the arts and decencies of civilized life. But the information which they furnish of this, as well as of other places of South Africa, must be taken with very considerable abatements. From them, however, a few facts may be gleaned, such as, that the face of the country is diversified with mountains and plains; that it is watered by the Zaire, the Ambrisi, the Loze, the Danda, and many smaller rivulets and rills; but the greater part of what they say of the cultivation of the soil, and the civilization of the inhabitants, are exaggerations unworthy of regard.

Yet Congo is an interesting country,—and the recently published narrative of Captain Tucky and Professor Smith, of the expedition sent in 1816 to explore the river Zaire, enables us in some measure to gratify our curiosity, by conveying to us a considerable portion of accurate and well authenticated information concerning its physical, social, and moral condition.

Physical state.—The river Congo, Zaire, or, as it is called by the natives, Morenzi Enzaddi, (the great river, or the river which absorbs all others,) was found by Captain Tucky and his party to correspond in depth, but not in velocity, with Maxwell's chart. The channel near its mouth is impeded by numerous shoals and large islands; at Cape Padron, about 140 miles upward, it is contracted into a narrow bed; and a few miles farther up, at a place called Casan Yellala, the cataracts commence. From this place to Inga, a distance of 40 miles, the river is squeezed into a channel, seldom exceeding 500 yards in width, and in many places it is much narrower; the whole length of which is bristled with sharp rocks, and frequently obstructed by shelves or dykes. At Casan Yellala, the lowest of them, the river, agitated by the opposition it has already encountered, rushes violently down a steep of 30 feet of perpendicular height on a slope of about 300 yards in length, into an expansive and foaming basin below. But the people of the expedition were surprised to find the quantity of water precipitated over the fall to bear no apparent proportion to the vast volumes rolled from an expansive estuary into the ocean, though thence to the cataract its flood is augmented by the reception of no tributary stream; and they therefore conjectured, that a great mass of the water which fills the channels between their banks, must find its way through subterraneous passages under the rocks—an opinion which acquires probability from the whirlpools that disturb the current at no great distance below the last of the falls, and from the schistose structure of the mountains through which the narrows are protracted. At the same time it is not improbable, that Captain Tucky and his companions, who confess that, when they approached the Yellala, they were thinking of the cataracts of Niagara, may have been deceived as to the quantity of water forced in a narrow channel down a steep descent. Above the narrows the river expands over a bed from one to five miles broad; and still farther on it assumes a majestic appearance—flowing slowly through a fertile country, and, as its reaches open to the eye, forming a chain of mountain lakes, fringed with scenery of exquisite beauty. The opinion that this river is constantly swollen with freshes, is now proved to be a mistake; but, like other tropical streams, it has its periodical floods, and, during the continuance of them, the regular rise of a few inches a day, from the 1st of September to the month of March, when they have reached the height of eleven feet, which they seldom exceed, would seem to indicate that they proceed not from an accumulation of mountain torrents, but from the overflowings of an inland lake. And though the identity of the Zaire and the Niger be still an unsolved geographical problem, the opinion that the former is fed from sources (perhaps the lakes of Wangara) situated on the north side of the equator, is rendered extremely probable.

The face of the country through which the Zaire flows, so far as it was explored, exhibits great diversity of surface as well as of soil and produce. At first the alluvial banks are clothed with the most exuberant and various vegetation, presenting to the eye a boundless forest of majestic trees, clothed with foliage of never-fading verdure. Some of the islands are mantled with the thick mangrove, mingled with the elegant palm; and others are covered with Egyptian papyrus, resembling at a distance fields of waving corn. The highest points of the mountainous district rise about 2000 feet above the adjacent ocean, and, except coarse grass, are wholly destitute of vegetation; the lower ranges have no grand forests on their summits or their sides, but are thinly strewed with scattered trees. These mountains are composed of micaceous schistus, quartz, syenite, and a few other primitive rocks. Among their ravines are many fertile and pleasant spots, and even their summits, which Captain Tucky calls *plateaus*, are capable of cultivation. Beyond the narrows the character of the country changes from a mountainous region to a fine undulating hilly district, of great beauty and fertility. The masses of micaceous schistus also, on the banks of the river, give way to ferruginous earth and promontories of marble, which divide the river into reaches, like mountain lakes, with banks as beautiful as those of the Thames. But here the party, having lost their baggage, and being exhausted with fatigue, were reluctantly obliged to retrace their steps.

The climate was found to be delightful—cool, dry, and refreshing breezes setting in from the west soon after the sun had passed the meridian, and continuing to fan the atmosphere till midnight. The water of the river invariably raised the thermometer to the 76th degree; and in the shade it ranged from 70° to 90°, though it was observed occasionally to fall to the 60th and to rise to the 100th degree. The rainy season extends from September to March. The first rains fall twice in the 24 hours, from the beginning of September to the middle of October; the second rains fall from November to January, attended with great heat and occasional hurricanes; and the third rains continue during February and March, accompanied with storms of thunder and lightening.

The plants of this prolific region are too various for enumeration, and botany has been enriched with the collections of Dr Smith and Mr Lockhart. The trees, however, that most frequently meet observation are, the mangrove, the bombax, the adansonia, the ficus, the plantain, the orange, the lime, the tamarind, and several species of palms. Among the alimentary plants, growing spontaneously, or with very little cultivation, are manioc, maize, yams, sweet potatoes, pumpkins, millet, cabbage, spinach, pepper, tobacco, sugar-cane, pine-apple, and ground-nut. Beasts of burden are unknown; but goats, hogs, sheep, Muscovy ducks, and pigeons are domesticated, and are plentiful. The elephant, the lion, the leopard, the buffalo, monkies, and antelopes of several species, hogs, porcupines, hares, and many other kinds of quadrupeds, inhabit the country. Guinea-fowl, red-legged partridges, wild pigeons, parrots, and king-fishers, frequent the woods or the banks of the rivers. Troublesome insects, except fleas and bugs, which swarm in the huts, are rare; many colonies of black ants, which make for themselves mushroom-shaped habitations, are not uncommon.

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Bees are abundant; and as the country abounds with tracts adapted for pasture, Congo might easily be made to *flow with milk and honey*. The crocodile and the hippopotamus are frequently seen in the river or basking on its banks. Bream, mullet, cat-fish, sparus, and some species of shell-fish, are abundant.

Social state.—The inhabitants are not nearly so numerous as they are represented to be in the Portuguese accounts. They are evidently a mixed race, having no national physiognomy, and many of them perfectly south European in their countenances, a circumstance which suggests the conjecture that the peculiarity is owing to their intercourse with the Portuguese; and yet there are very few mulattoes among them. They are generally about the middle stature, with much symmetry of shape, deformed, however, by the cicatrices of wounds inflicted on various parts of their bodies in childhood or youth, to increase their beauty, according to their own ideas of that quality; most of them, too, are loathsomely filthy, smeared with ochre and oil, or covered with itch. Their dress exhibits a motley mixture of European and African costumes. One chief officer is described as having his naked body enveloped in a red velvet pelisse, edged with gold, while others of them had on the most uncouth and grotesque assortment of European habiliments, procured from the slave-ships, and associated, in the most ludicrous manner, with their own ornaments. But the common people are content with a narrow apron, a few inches broad and about a foot long, formed of baft or grass, according to their circumstances. Many of them wear grass caps on their heads, ingeniously and neatly formed. They all wear rings of brass or iron around their wrists and ancles, and some of them have bracelets of lions' teeth. The women have strings of beads of cowry shells, or of different sorts of seeds round their necks and arms. All who have any pretensions to gentility bathe in the morning, and then rub their bodies over with palm oil. They salute each other by gently clapping the hands, and an inferior at the same time goes on his knees and kisses the bracelet on the superior's leg. Their huts are formed by stakes stuck in the ground, to which mats of reedy grass are fastened, with a roof of the same. The household utensils are few and simple; baskets of the fibres of the palm-tree; bowls and bottles of gourds; earthen pots to cook, wooden spoons to eat their food; and a grass mat, thrown on a platform of palm leaves, to serve as a bed, comprehend the whole. They are foul feeders, broiling their fowls unplucked, and their joints of meat without removing the skin or hair, and then, while it is still half-raw, tearing it with their teeth in the most disgusting manner. But there is no proof of their eating human flesh, even that of their enemies. Their huts are not scattered over the face of the country, but collected into *Banzas* or villages, situated in the most fertile spots on the banks of the river or the ravines of the mountains. The most considerable of these which occurred in the route of the English adventurers were *Embomma*, a village containing 500 inhabitants; *Cooloo*, with 100 houses and 600 inhabitants; and *Inga*, the highest within the kingdom of Congo, with 300 inhabitants. These and the other villages of the country stand amid groves of palms and Adansonia trees, and plots of cultivated land. The hoe is the only instrument of agriculture, the soil requiring nothing but a slight scratching to ensure a plentiful harvest.

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The constituent parts of a Congoese community are, the *Chenoo*, the members of his family, the *Mafooks*, the *Foomos*, the fishermen, coolies, and labourers, and domestic slaves. The existence of a paramount sovereign is doubtful, as the Chenoo seems to possess supreme power in civil matters within the sphere of his own jurisdiction. The title and authority of the Chenoo, (improperly called king, as one of them was found in almost every village,) is hereditary through the female. In consequence of this custom, a Chenoo's daughter has the privilege of choosing her own husband; but the man on whom her choice falls has frequently little cause to be proud of the honour; for on trial, should he not answer her expectations, she has also the privilege of selling him for a slave. A Chenoo's house is constructed of stakes and palm leaves, and is divided into several apartments. The lion's skin is sacred to him for a seat, which to touch with a plebeian foot is slavery or death. His uncles, brothers, and sons, are his counsellors; and in time of war the elders of them stay at home to guard the village, while the juniors under the Chenoo lead on the army to battle. The *Mafooks* are the collectors of the revenue. They generally begin life as interpreters to the slave-dealer and the European merchant, and, like other middle men, accumulate fortunes, with part of which they buy the office of *Mafook*, and are ever after dumb as interpreters. The *Foomos* are the yeomanry of the country, and have possessions of houses and lands of their own. The names fisherman, labourer, slave, sufficiently indicate the condition of the inferior classes. Domestic slaves, however, are not numerous, and consist of persons degraded to that state for their faults; but they are not made transferable property. Saleable slaves are prisoners of war, and persons kidnapped from another tribe.

Polygamy is common, and the Chenoos have sometimes 50 wives; but females, married and unmarried, are reduced to the lowest state of degradation. They cultivate the soil, collect food in the woods, and perform all those offices which require laborious exertion or incessant drudgery, while their fathers, brothers, and husbands are making grass mats and caps, stringing beads, sauntering in the fields, or sleeping in the huts. They have songs on love, war, and palm-wine; and musical instruments, such as rude lyres, horns, shells, drums, and calabashes filled with stones. They do not delight in feats of activity, but in dancing, or rather exhibiting indecent motions and gesticulations, chiefly on moonlight nights.

Salt, palm-oil, and wine, ground-nuts, pepper, maize, and mats for sails, are the principal articles in which they traffic. They are anxious that the slave-trade should continue, and are, in consequence of that detestable trade, well acquainted with the value of the cloth, beads, knives, muskets, and the other articles given in exchange for the hapless victims who have the misfortune to fall into the state of slavery. Their canoes are about 24 feet long and 20 inches broad, hollowed out of the *bombax* or wild cotton tree, or a species of *ficus*. Itch and scrofula, leprosy and elephantiasis, fever and fluxes, are the most prevailing diseases, (though they seem in general to be healthy,) which they endeavour to cure by decoctions of native plants.

Moral state.—It would be unfair to expect elevation or consistency of character from these barbarians; for the moral perception must ever be languid and indistinct, when the mind is unimproved and the habits debased; and hence the customs and conduct of the Congoese are contradictory, and in many cases highly culpable and pernicious. Thus, while adultery among themselves is a capital crime, they frequently give up their wives and daughters to strangers, and the ladies themselves, nothing loth, are in high dudgeon when their favours are slighted. They are represented as of a good humoured and hospitable disposition; and yet, in their expectations of presents, they displayed extreme selfishness and cupidity. They are passionately fond of brandy, but their own palm wine is their common beverage. That they are no strangers to the kindly feelings of natural affection, is evident from the conduct of the father of a young man of the name of Simmons, who some years before had left his country for England, and had returned home with the expedition. When his father saw his son again, his joy was excessive, and he held him long in his embrace, and the rest of his family and tribe gave him a cordial welcome home. Murder and theft are punished by restitution; and for these and other crimes and offences, the accused is obliged to undergo a trial by ordeal, which makes his guilt or innocence depend on the strength of his stomach; for he is made to chew a poisonous bark, which, if innocent, he throws up and is acquitted, but if guilty he retains and is poisoned.

Very few traces of Christianity are to be observed among these Africans at present, notwithstanding the swarms of missionaries who at one time visited them from Portugal. Many of them, however, are nominally Christians; one negro Christian priest visited the ships; and this barefooted black apostle, though ordained by the Capuchin monks, had five wives. Their own superstition is abject and pernicious. Every man has one or more *fetiches*, or tutelar deities, against every possible evil which may befal him. These *fetiches*, or gods, are made of the horns, hoofs, hair, or bones of quadrupeds; of the feathers, beaks, claws, skulls, and bones of birds; of pieces of old iron, copper, wood, seeds of plants, and sometimes of a mixture of all these, and of other things equally vile. The *fetiches* are worn about their persons, or set up in their houses. And when they are involved in calamity, no blame or neglect is ascribed to the idol, but to themselves, in not serving him with sufficient constancy or warmth of devotion. Prayers are addressed, thanksgivings returned, abstinence instituted, and penalties inflicted to these senseless objects of their veneration. They have some vague notion of a good and evil principle, and believe in spirits of the hills, and vallies, and waters; but the *fetiches*, as having sensible existence, are regarded with the greatest fear; in honour of which they frequently consecrate a large portion of their substance, which becomes in consequence the property of the gamams or priests, persons who have a great deal of influence. They have some ill-defined idea of a future paradise, where they shall all be happy; and, from some peculiarity of superstitious feeling, keep their dead long unburied, enfolding them in a succession of wrappers till they have attained a most unwieldy bulk, when they are deposited in a very deep grave, which is afterwards planted with trees, and shrubs, and flowers. A great man's grave is distinguished by having an elephant's tusk at its head and foot.

CONGREVE, William, a distinguished dramatic writer, descended from a family of the same name in Staffordshire, that could trace its ancestry beyond the period of the Norman conquest, was educated first at the school of Kilkenny, and afterwards at the university of Dublin. The time and place of his nativity are uncertain; it is known, however, that the former was in the year 1671 or 1672, and that the latter took place either in England or Ireland. That he was a native of the Green, and not untuneful, Island, rests on the testimony of Mr Southern, his intimate friend, who censured his abnegation of his country as an unworthy meanness, and on the circumstance of his having been educated in Ireland from his childhood: and the evidence of his having been born in England is derived from the knowledge that his father, the second son of Richard Congreve, Esq. of Stratton, in the county of Stafford, was only accidentally in Ireland as an officer in the army, which accounts for his sending his son to the Irish schools, and from the poet's own declaration to Giles Jacob, that the place of his nativity was Bardsa, near Leeds,—a statement in which all his biographers, with the exception of Dr Johnson, have shewn themselves disposed to acquiesce, and which Malone has proved by the production of the entry of his baptism in the parish register.

Congreve's genius was of that forward kind which, to the astonishment of the world, bursts forth at once and unexpectedly, like the dazzling corruscations of the meteor; but, in its duration and increasing splendour, it rather resembled the morning light, which shineth more and more unto the perfect day. His father, desirous of turning the studies of his son to some good account, sent him to England, and placed him a student in the Middle Temple, where he lived several years, not diligent in the examination of statutes and reports, but in such studies as coincided with his own inclination. His first publication was a romance, entitled, *Love and Duty reconciled*, which displayed fluency of style and strength of judgment; and which, for a boy of his age, was altogether an extraordinary performance. The reception of this first attempt at authorship, which he had published under the assumed name of Cleophil, inspired him with confidence in the spirit of genius that stirred within him; and in the 21st year of his age, he finished the popular comedy of the *Old Bachelor*, which, he said, was composed for his own amusement during a slow recovery from a fit of sickness. This play, revised and fitted for the stage by Dryden, Southern, and Mainwaring, was first performed in 1693; and not only enwreathed its author's brow with laurels, but filled his pockets with profit. The anticipation of a favourable reception induced the manager to allow him the privilege of the house half-a-year before its exhibition; and after it was acted Halifax became his patron, and, after two less lucrative situations, gave him an office in the customs which brought him L.600 a-year,—favours which, as it afterwards appeared, he deserved not more for the transcendancy of his genius, than for the warmth of his grateful affection.

The Double Dealer was soon after brought upon the stage, and its performance honoured with the presence of the queen, but was not received by the public with the same degree of flattering applause as its predecessor had been. Next year produced *Love for Love*, written with more knowledge of life and maturity of genius than either of the former. In less than two years afterwards, *The Mourning Bride* was exhibited with entire approbation, and soon became popular; and thus before he had passed his 25th year,---an age at which even those who are destined to rise to distinction in the republic of letters have found it necessary to pass their time in solitary study,---Congreve's precocity of mind had given to the world four regular dramas, rich with intellectual excellence.

About this time, Collier, a fierce and implacable nonjuror, published *A View of the Immorality and Profaneness of the English Stage*, in which, without any compliments to his genius, he attacked Congreve in forcible and vehement language, and with keen and sarcastic wit, as a dangerous and destructive writer. The poet replied, and the critic rejoined, till he triumphed over his antagonist, and received his reward in the reformation of the theatre. In this controversy, Collier accumulated together, and exhibited in one view, all those passages in the plays which had a licentious or an irreligious tendency, and thereby excited the horror and the indignation of the pure and the pious. Congreve's answer is drawn up in the form of letters, and addressed to Walter Moyle, and contains as good a defence as his cause was capable of receiving.

After this event he contributed nothing to the stage except the comedy of the *Man of the World*, which was not favourably received; a masque, entitled the *Judgment of Paris*; and *Semely*, an opera. He contributed one paper to the Tatler, and published his *Miscellaneous Poems*; after which he lived many years in literary indolence, and in the enjoyment of an extensive circle of friends. When his patron went out of power, he was continued in office; and when he returned to power, he was made secretary of the island of Jamaica, a sinecure which added an additional L.600 to his income. His honours also increased, every writer mentioning him with respect; Steele made him the patron of his Miscellany, and Pope inscribed to him his translation of the Iliad. But he was ungrateful to the Muses, and wished to be regarded rather as a man of fashion than an author,---a piece of affectation, for which he was properly and severely rebuked by Voltaire, who told him, had he been merely a gentleman he should not have come to visit him.

In his latter days he was afflicted by cataracts in his eyes, which terminated in blindness; disabled and kept in pain by frequent attacks of the gout; and having been overturned in his chariot, he afterwards complained of a pain in his side; and, in January 1728, died at his house in Surrey-street. He was laid in state in the Jerusalem-chamber, and buried in Westminster-abbey, where a monument is erected to his memory by the duchess of Marlborough, to whom he bequeathed a legacy of L.10,000.

CONI, or CUNEO, a town of Piedmont in Italy, stands at the confluence of the rivers Gezzo and Stura; is strongly fortified, and contains more than 16,000 inhabitants. This place dates its origin in the beginning of the 12th century, when a chapel, dedicated to the Virgin, acquired great reputation for sanctity, and attracted great crowds of pilgrims from all quarters. The surrounding territory is rich and fertile, and produces abundance of grain.

CONIUM, Hemlock, a genus of plants belonging to the Pentandria class.

CONJUGATION, a term in grammar, denoting the regular distribution of the several inflections of verbs, in the different moods, tenses, and persons, so that they may be distinguished from each other. See *Grammar*, under Language.

CONJUNCTION, a term in astronomy, which signifies the meeting of two or more stars or planets in the same degree of the zodiac.

CONJUNCTION is an indeclinable word, or particle, which joins words and sentences together, and thus marks their relation or dependance on each other. See Language.

CONNARUS, Ceylon Sumach, a genus of plants belonging to the Monadelphia class.

CONNAUGHT, one of the four provinces of Ireland, is bounded on the east by the province of Leinster, on the north and north-west by part of the ocean and province of Ulster, on the west by the ocean; is about 130 miles in length and 84 miles in breadth, and includes one archbishopric, and five bishoprics, and is divided into the counties of Galway, Leitrim, Mayo, Roscommon, and Sligo.

CONNECTICUT, one of the United States of North America, forms, between the 41° and the 42½° of north latitude, and the 71° and the 73° of west longitude, an area of about 100 miles in length by 72 in breadth, bounded by Massachusets on the north, by Rhode island on the east, by the strait called the Sound which separates it from Long Island on the south, and by the territory of New York on the west.

Physical state.---The surface of this part of North America is diversified by mountains and vallies, fast-flowing rivers, and widely-extended estuaries. The mountainous parts lie towards the west and the north, and, as is usual in the New World, are covered with thick forests, containing an endless variety, and an inexhaustible quantity of timber trees; veins also of lead, copper, zinc, and iron, as well as crystals of salt, have been discovered, and partially worked in various places. Of the rivers, Connecticut, or Quennehticut, is the most magnificent, not only of this but also of the whole of New England, of which this state forms a constituent part. Its source is not far distant from lake St Pierre, in Canada, where it interlocks with the head branches of the river St Francis, and flows in a southerly direction in a channel of about 300 miles in length, between the states of Vermont and New Hampshire and the province of Lower Canada, and traverses the whole breadth of the state of Massachusets before it enters that on which it has imposed its name; within this state it receives the Farmington and several other tributary streams; and having mingled with the tide at Hartford, it thence proceeds in a winding course till, between the towns of Lyme and Saybrook, it falls into Long-island sound. In some parts of this course it is contracted by mountains which approach to its margin, but in general its banks expand into flat savannahs, which are frequently overflowed and covered with a rich and nutritious sward of herbage. Its mouth is impeded by a bank of sand, which excludes ships of burden, and in different parts of its course are shoals, on which the flat-bottomed boats, by which it is navigated, are stranded; yet, by means of artificial channels, it is navigable fifty miles above its mouth for vessels of considerable size; and the falls which occur in this distance are surmounted by locks. It is frequented by sturgeon, salmon, shad, pike, carp, perch, &c. which are taken in abundance.

The Housatonick river is next in size, and rises in the mountains of Massachusets. In its course it passes some thriving towns, falls into the sound between Stratford and Milford, whence it is navigable for 12 miles upward. Between Salisbury and Canaan, where its channel is 150 yards in width, and its stream of considerable depth, it falls in a white sheet about 60 feet of perpendicular height, forming a cataract of great magnificence.

The Thames, like the former, has its source in Massachusets. One of its falls deserves also to be described, in which the whole volume of its water is dashed over a cliff twelve feet in height, from which it rushes, with a thundering noise and a dazzling rapidity, in a steep, rough, and contracted channel, into a spacious basin, where it foams and boils with tremendous agitation. This river is navigable for more than fourteen miles above its mouth, which forms a good harbour at New London that overlooks the sound. The other rivers are, the Byram, which forms the boundary line between this and the state of New York; the Naugatuk, a tributary stream of the Housatonick; the Haven river; the Mill river, the West river; and a great number of smaller streams.

The soil, as must necessarily happen in uneven and broken surfaces, is various in respect of its quality. On the banks of the rivers it is deep and fertile; and on the higher parts it is stony, thin, and comparatively barren. The climate, though variable, is salubrious. The principal productions are maize, rye, wheat, oats, and barley, flax, hemp, turnips, pease, beans, pumpkins, and potatoes. The expansive and rich meadows of the state are well fitted for breeding and fattening immense numbers of cattle, sheep, and other stock. Horses and mules are also numerous.

Large orchards of mulberry trees have been lately planted; and silk, not only for home consumption, but also for exportation, has been produced.

Political state.—Connecticut is divided into eight counties, Fairfield, Newhaven, Middlesex, New London, Lichfield, Hartford, Tolland, and Windham. Hartford and Newhaven are the capitals of the state, and, with New London, Norwich, and Middleton, are incorporate towns. Hartfield stands in 41° 40′ north latitude, on the west bank of the river Connecticut, about 76 miles south-west of Boston, and 91 north-east from New York. It is well situated for trade, in a fertile and agreeable part of the country, and contains more than 20,000 inhabitants.

Newhaven, the other capital, is situated at the head of a bay of the same name, in a large plain, surrounded by mountains, and has about 4000 inhabitants. The houses are built chiefly of wood, on a regular plan. The harbour is large, with good anchorage, and the town carries on a considerable trade with New York, from which it is distant 62 miles. Yale college, originally founded at Killingworth, was in 1716 removed to this town. Its officers are, a president, a professor of divinity, and three tutors, who teach the learned languages, polite literature, philosophy, and theology, and have the power of conferring degrees. Dr Berkely, the celebrated bishop of Cloyne, made a handsome donation to this seminary, which has a good library, a museum, and a philosophical apparatus. A cave in the neighbourhood of this town was sometime the retreat of Walley and Goff, two of the judges of King Charles I.

New London, a small town composed of about 600 dwelling-houses, on the west side of the Thames, and three miles from its entrance into the sound. The harbour, with five or six fathoms water, and a clear bottom, open to the south, is defended by two forts. On the west side of the entrance is a lighthouse, on a point of land that projects into the sound.

Norwich, a manufacturing and trading town, with three churches, and about 3000 inhabitants, is situated between two rivers, about 14 miles north of New London. Middleton, a trading town, of 300 houses, besides public buildings, is pleasantly situated on the right bank of the Connecticut, in a rich and extensive country. The streets are broad, and bordered with trees, and the town has a lead mine in its vicinity. Wetherfield, an agreeable town, and the birth-place of Silas Deane, one of the first promoters of the American revolution, consists of about 300 houses, in a fruitful tract, four miles south of Hartfield. Fairfield is situated at the west corner of the state, near the coast of the sound, was burnt by the English in the last war, but has been rebuilt, and has about 300 houses. Farmington, a pleasant and healthful town, situated on the stream of the same name, is built chiefly in one street, on the declivity of a hill. Windsor, Guilford, Stratford, Milford, Lichfield, Fairfield, Glastonbury, Saybrook, Haddam, &c. are small but thriving towns, rising, with most of the others in the state, into importance by the establishment of manufactures, and the extension of trade. For in all those towns which have been described or enumerated, the inhabitants find profitable and useful employment in the various branches of industry. A large woollen manufacture, under the protection of the legislature, is established in Hartford. Linen and buttons are made in Newhaven; glass, iron, paper, nails, hats, leather, &c. are manufactured in most of the towns. An oil, equal to that of Florence, is said to be expressed from the sun-flower, and used in sallads, in medicine, in paints, varnishes, and ointments. The trade of the state is chiefly with the neighbouring states, and with the West Indies, to both of which it sends salted beef and pork, grain, fruit, hay, horses, oxen, mules, oak staves and planks, beans, maize, salted fish, potatoes, &c. for which are obtained rum, indigo, and money. Hartford is the great emporium of inland produce, which is brought to it in boats down the river Connecticut. The vessels employed in the West India trade are from 60 to 140 tons burden.

The constitution of the state is founded on a charter granted by Charles II. in 1662, and consists of a supreme legislative body, called the General Assembly, and various civil and criminal courts which act under its appointment and cognizance. The general assembly sits twice in the year, in May and October, and is divided into the upper and the lower houses, the former of which is composed of a governor, deputy governor, and twelve councillors, and the latter of the representatives of the people. The members of both houses are elected by the freemen, those of the *upper* annually, and those of the *lower* twice in the year; and, if they have attained maturity of years, are possessed of L.400 of yearly rental, or of L.40 of personal property, have a fair character, and respectable talents, they are eligible into either of the houses, and to any of the offices of government. Every town sends two representatives to the lower house of the general assembly, the collective number of which amounts to about 180. This body enacts new laws, nominates judges and sheriffs, grants pardons and reprieves to criminals, and commissions of bankruptcy, or protection to the persons and estates of debtors. The governor is captain-general of the militia, the deputy-governor lieutenant-general.

Justice is administered and punishment awarded through the medium of the county courts, the superior circuit court, and the supreme court of errors. Each of the *county courts* consists of a judge and four justices, and has jurisdiction over all civil actions which exceed the powers of a single justice, and over all criminal cases, the punishment of which extends not to life, limb, or banishment. *The superior court* holds two sessions in each county in the course of the year; it consists of five judges, who hear and determine all causes brought before them by appeal or reference from the inferior judicatories. And the *supreme court of errors*, which is composed of the governor, assisted by all the members of the higher house of the general assembly, determines writs of error brought on judgments of the superior court. The common law of England is adopted as the law of the state, and the decisions of the courts of England are read as authorities in the procedure of its courts. The expenses of the state are defrayed by a property-tax, each freeman furnishing a list of his possessions, which is forwarded to the general assembly, who calculate their amount, and impose a tax on them at a certain rate per pound.

Moral and religious state.—It may be inferred, from the number of its towns, that this is one of the most populous of the United States; and hence, on referring to history, we find that the descendants of the 3000 persons who, chiefly from England, settled in it about the years 1635-6, had, with the new comers, amounted to 261,727, exclusive of native Indians and African slaves. In respect of their appearance, the inhabitants are tall, healthful, and handsome; the females are celebrated for their beauty, virtue, and accomplishments. They delight in the amusements of dancing, fishing, hunting, and riding on the ice in sledges, a vehicle drawn by two horses, and made to carry six persons. Much attention is paid by the state to the education of the young of both sexes; a full third of the revenue is destined to the support of the schools and academies of the towns, and of the college of Newhaven; and the thirst for knowledge is said to be proportionable to the means of its attainment. The law of the state is published in a uniform code, and every individual is required to make himself familiar with all its provisions, a circumstance which accounts for the litigious temper by which most part of this people is distinguished. But this disposition, as well as that to religious controversy, which once prevailed among them, is said to be on the decline, and peaceable habits, with mutual forbearance, beginning to obtain the ascendancy. The Episcopalian churches are governed by a bishop, but the bulk of the people are Congregationalists, a form of religious worship and discipline taught them by their puritan ancestors.

History.—The first grant of Connecticut was made by the Plymouth council, in 1630, to the earl of Warwick, who, in the following year, assigned it to Lord Say. In 1635, a number of planters from Massachusets settled at Hartford, Windsor, and Springfield, and other places on the great river. And in 1639 the towns on that river formed themselves into a body politic, and agreed on articles of civil government, which became the basis of the charter which they obtained in the year 1662. This state, notwithstanding the declaration of its independence, has not materially altered its constitution, which exhibits a good specimen of an efficient and orderly republic. But while it has been careful to resist political change, it has, by the extension and improvement of agriculture, the introduction of manufactures, and by commercial enterprize, risen rapidly to political importance.

CONCARPUS, Button-wood, a genus of plants, belonging to the Pentandria class.

CONOID, a term in geometry, which denotes a solid body, generated by the revolution of a conic section about its axis.

CONOPS, a genus of insects belonging to the order Diptera. See Entomology.

CONSCIENCE, a power or faculty which approves of certain actions, or those that are naturally good, and condemns other actions, or such as have an opposite quality. It has been termed by some writers on ethics the *moral sense, or the moral faculty;* and is considered as an original faculty of human nature, which, when it is unbiassed, instantaneously decides on the propriety or impropriety of human actions. See Moral Philosophy.

CONSCIOUSNESS has been defined the immediate knowledge which the mind has of its sensations and faults, and in general of all its present operations. But the term has been employed in a more enlarged sense, and to denote the distinctive quality between animals and those beings which are destitute of life and organization. It is the testimony of the existence of the mental powers, and of the perception of external objects. See METAPHYSICS.

CONSECRATION is the solemn act of devoting a person, or place, or thing, to some religious purpose; examples of which are well known in Jewish history; as when the first-born, both of man and beast, were commanded, by the institution of Moses, to be sanctified or consecrated to God; Aaron and his sons were set apart, or consecrated to the priestly office; and the temple of Jerusalem was dedicated to the service of the Most High by a solemn religious service. Among the Romans, the consecration or inauguration of the high priest, or *pontifex maximus*, was accompanied with many rites and ceremonies, and, among others, with the sacrifice of a bull, whose streaming blood was received on the body and vestments of the candidate to be appointed to the sacred office. In the Christian church, those who are more immediately set apart for the service of religion are consecrated or ordained. Churches are also consecrated; and this practice, of which the commencement is not distinctly ascertained, seems to have generally prevailed in the time of Constantine. The practice of consecrating churches, as well as of church-yards, when employed as burying-grounds, and of burying-grounds in general, is observed in the church of England and in the church of Rome. The water, oil, and other things employed in religious services, are solemnly consecrated.

CONSISTORY is a term analogous to tribunal, and is usually applied to a session or assembly of ecclesiastical persons, or place of justice in a spiritual court. All archbishops and bishops of dioceses have consistory courts held before the chancellor or commissary for ecclesiastical causes.

The consistory at Rome is composed of the college of cardinals, or the pope's senate and council, before whom causes relative to the affairs of the church are heard. At the private consistory, the pope himself and his cardinals only are present; and their opinions or decisions are called sentences. In this private consistory are passed all bulls for bishoprics, abbeys, and other religious establishments; and hence bishoprics and abbeys are denominated *consistorial benefices*.

CONSONANCE, a term in music, denoting the union or blending of two sounds which are produced at the same time.

CONSONANTS are letters of the alphabet which cannot be sounded without a vowel. See *Grammar*, under LANGUAGE.

CONSTABLE, derived, it is supposed by some, from a Saxon word signifying stay or support of the king, or, according to others, from the Latin name of an officer well known in the empire, to whom was entrusted the regulation of all matters of chivalry and feats of arms which were conducted on horseback, is an officer having different powers and authority according to the purpose for which he is appointed.

The lord high-constable of England is the seventh great officer of the crown, and possessed of extensive power, dignity, and authority, both in time of war and peace. This office existed before the conquest; after that period it became hereditary; and in 1521 it was forfeited in the person of Stafford duke of Buckingham, who was attainted for high treason. Since that time the appointment is only temporary, during a coronation, or trial by single combat.

The lord high-constable of Scotland, which is heritable in the noble family of Errol, to whom it was granted by king Robert Bruce, was formerly an office of great dignity and power. He had the command of the king's armies in the field in the absence of the king, and was the judge of all offences committed within two leagues of the king's house, which precinct was called the chalmer of peace; but in latter times his jurisdiction existed only during the time of parliament.

Constables of an inferior description, which are divided into high and petty constables, are appointed generally for the purpose of keeping the peace, and are entrusted with different powers, according to the nature of their office and the districts to which they are appointed.

CONSTANCE, a town in the circle of Swabia in Germany, occupies a fine situation on the banks of the Rhine, and near the south-west extremity of the lake from which it derives its name; is a place of considerable antiquity, and contains several buildings which are distinguished by their magnificence: The hall in which the famous council of Constance was held from 1414 to 1418; the house in which John Huss was seized, the dungeon in which he was confined, and the place where he was burnt along with Jerome of Prague, are still pointed out. Constance has greatly declined; but in 1787 had revived, by the accession of Genoese emigrants, who were encouraged by particular privileges. The population is stated at 3000; and watch-making is carried on to a considerable extent.

The lake of Constance is a fine expanse of water, which separates Switzerland from Swabia, and is divided into three parts, of which the upper lake, called the *Boden-see*, is the largest, and is about thirty-six miles in length and fifteen miles at its greatest breadth; the middle part is called the *Bodmer-see*, and the lower part the *Zeller-see*. The depth of the water is greater in summer than in winter by the accession of the melted snow. This lake contains some islands, on one of which, at the eastern extremity, stands the town of Lindau, formerly a free imperial city; on another, in the middle branch, is an establishment for knights of the Teutonic order; and the surrounding territory is finely diversified with gentle elevations, towns, villages, and religious houses.

CONSTANTIA, a small district at the Cape of Good Hope, consisting of two farms, which produce the celebrated Constantia wine. One of the farms, called Little Constantia, yields a white wine, and the other produces the red Constantia. The rich quality of this wine is ascribed, by some travellers, partly to the situation and soil, and partly to the care and attention bestowed on its manufacture. Ripe fruit only is employed, and it is always entirely freed from the stalks.

Constantine

CONSTANTINE, surnamed the Great, was the son of the emperor Constantius by his empress Helena, and was born in 272 at Naissus in Dacia, but spent his youth chiefly at Nicomedia, where his beauty, accomplishments, and signal services, made him extremely popular, and procured him the office of tribune of the highest order. His father, who was in Britain with the army, feeling the influence of the decay of his constitution, sent for his son, who, in 306, arrived at York, just in time to see him expire. The army instantly invested him with the purple; but his sovereignty was at first confined to the provinces beyond the Alps, and he was obliged to maintain a long struggle with several powerful rivals before he obtained the sole power in the empire. It is said, that as he was going to fight against Maxentius, one of these rivals, he saw a cross in the sky, with the inscription, *Conquer by this;* and that from this circumstance he adopted the cross as his military standard, and became a convert to the Christian faith. After he became sole emperor, he employed himself in the reformation of the state, and the improvement of his people, by whom he was much beloved. Finding that Rome was too remote from the provinces of the east, the richest of the empire, he built a splendid city on the site of ancient Byzantium, which, from his own name, he called Constantinople, and to which he removed the senate and the court, so that it soon became the formidable rival of Rome, till then the undisputed mistress of the world.

But, amid the splendour and the power of imperial greatness, Constantine was involved in severe domestic troubles. He had a son by his first wife Minervina, named Crispus, a youth distinguished for knowledge and valour, and in all respects indeed of the fairest promise, whom, it is said, Fausta, his father's second spouse, had in vain attempted to seduce. Enraged that her guilty proffer was rejected, the adultress accused him to her husband of having endeavoured to violate his bed. This false accusation, enforced by the insinuating address of an artful and an abandoned woman, eager for revenge, was unfortunately too readily listened to by her husband, who, rendered credulous, perhaps, through jealousy of his son's popularity, which seemed to threaten his own, inconsiderately and cruelly doomed him to die by poison. The falsehood of Fausta was afterwards detected and punished; but the sudden and mysterious disappearance of Crispus raised surmises among the people, hostile to the affection they had hitherto cherished for their emperor; his own consciousness of guilt must have destroyed the peace and tranquillity of his thoughts; and the well-grounded suspicion that he had a hand in the death of his own son, has tarnished the lustre of his fame with posterity.

Constantine took a deep interest in the Arian controversy, and exerted himself to the utmost to bring the contending parties to an amicable understanding. With this view the council of Nice was convoked, held their deliberations, and passed their decrees. After an active life of sixty-five years, and a reign of thirty, he died in the neighbourhood of Nicomedia, where he had passed a considerable part of his youth; his body was conveyed to Constantinople with the same state and attendance as if he had been alive; and all the forms of court were maintained, till political affairs were put into a posture suited for the disclosure of his demise. The reign of this prince, the subject both of praise and blame by different classes of authors, forms an important era both of civil and of ecclesiastical history.

Constantinople.

CONSTANTINOPLE, the ancient Byzantium, and now called by the Turks *Stamboul,* is the capital of the Turkish empire, and stands on the western shore of the Thracian Bosphorus, or strait which separates Europe from Asia. This celebrated city was enlarged and beautified by the Roman emperor Constantine the Great, in the year 330; and having at the same time transferred the seat of empire to the new city, he dignified it with his own name. Numerous splendid remains of Grecian and Roman antiquity are yet visible within its precincts. The sea forms the boundary of Constantinople on several sides, and towards the land it is secured by a strong wall, flanked with lofty towers. The whole circumference of the city is estimated at 12 English miles; and the summits of the seven hills on which it is built are adorned with numerous mosques and baths, among which groves of the lofty cypress wave their heads; while the painted houses, gilded domes, and tall slender minarets, convey to the spectator an impressive feeling of its splendour and magnificence. But the interior of the city ill accords with the striking view which it exhibits at a distance. The streets are narrow and dark, ill-paved, and covered either with dust or mud; and the houses, constructed of wood and earth, are generally low and mean, destitute of chimnies, and with unglazed windows. The palace and gardens of the seraglio, which occupy one of the seven hills, are situated on the eastern promontory.

Among the public edifices of Constantinople, the church of St Sophia, which is distinguished by its magnificence and elegance, holds the first place. It is supposed to be the first Christian church which now exists, and was erected by Constantine the Great. Some of its finest ornaments belong to ancient temples; six columns of green jasper were taken from the temple of Diana at Ephesus; and eight columns of porphyry were removed from the temple of the Sun at Rome, by the original founder. Some of the other mosques were also originally Greek churches. Besides some Jewish synagogues, several Christian churches, some of which belong to the Greeks and Armenians, some Roman Catholic convents, and one occupied by Swedish Lutherans, have been permitted within the city.

The bazars, or market-places, are extensive, and occupy numerous streets, where every kind of commodity is exposed to sale. Every trader, or dealer, has a particular quarter assigned to him, and the different trades are appropriated to different nations, who are distinguished by the dress of their respective countries or professions. The khans, or hotels, constructed of stone, and proof against fire, are destined to merchants who come from different parts of the empire, and who are accommodated with lodging for themselves and warehouses for their merchandise in these edifices.

The suburbs of Constantinople, extending towards the north, are extensive and populous. Galata, which stands on the shore, was founded by a colony of Genoese in the 13th century; it was formerly surrounded with walls, and is now inhabited by merchants from all nations, who come under the general denomination of Franks. Pera stands on an elevated ridge, enjoys a pure air, and a charming prospect, and is appropriated for the residence of the embassadors and their attendants from different European nations. Scutari is also considered a suburb of Constantinople; it stands on a declivity on the Asiatic side of the channel, and the houses, mosques, and minarets, mixed with trees, exhibit a picturesque scene. The burying-grounds in the vicinity of Scutari are very extensive, and are adorned with elegant tombs and thick groves of lofty trees. The wealthier and higher classes of the Turks prefer this spot for a cymetery.

The harbour of Constantinople is formed by an arm of the Bosphorus, which separates the suburbs of Galata and Pera; is one of the safest and most commodious in the world; it is about seven miles long, and is so spacious as to be capable of admitting not fewer than 1200 ships at the same time; and from the steepness of the banks ships of the greatest burden may approach the shore to discharge their cargoes.

The population of Constantinople has been variously estimated; while it is stated by some at the enormous number of a million and a half, it is reduced by others to 300,000. The most probable computation is supposed to be about 400,000. The chief manufactures are a kind of stuffs of silk and cotton, brocaded with gold and silver flowers. This manufacture is chiefly carried on by Armenians, who, it is said, employ 10,000 looms in the city and neighbourhood. The commerce of Constantinople is chiefly in the hands of merchants of other nations; a very small share of it falls to the Turks.

The nature of the houses, many of which are constructed of wood, subjects the city to frequent calamities from fire; and in some of these conflagrations the whole city has been threatened with destruction; and the ravages of the plague have produced a terrible desolation at different times, as in two years, from 1783 to 1785, 100,000 children and young persons are said to have been swept off by that calamity.

CONSTELLATION, a cluster or system of several stars that are seen in the heavens near to one another, and distinguished by their relative situation and position. For the more convenient observation and discrimination of the stars in different constellations, they are assimilated to the forms of different animals, or of familiar objects.

CONSUALIA were festivals held by the ancient Romans in honour of Consus, or Neptune, and were different from the feasts of the same deity called *Neptunalia*. They were first instituted by Evander, and revived by Romulus.

CONSUL, a chief magistrate of the Roman republic, and invested with supreme authority. The consuls, who were two in number, were chosen annually, and, in the earlier periods of the commonwealth, always from the patrician order of citizens; but in the 388th year of the city the people obtained the privilege of electing one from their own body. A certain age and some other requisites were necessary for those who aspired to that honour. The number of consuls was encreased in latter times, but the original institution was restored by Constantine the Great.

In modern times the word consul is applied to a person who is appointed to attend to the commercial interests of the nation from whom his mission is derived, at the particular place where he is stationed.

CONSUMPTION, is a medical term applied to any wasting disease the causes of which are not very obvious, but is often restricted to *Phthisis pulmonalis*, or consumption of the lungs. See MEDICINE.

CONTRACT, a term in law, signifying a voluntary agreement between two or more parties, who mutually oblige themselves to perform certain stipulations. See LAW.

CONVALLARIA, LILY of the VALLEY, and SOLOMON'S-SEAL, a genus of plants belonging to the Hexandria class.

CONVENTION, in its general signification, denotes a treaty or agreement between two or more parties; but in English history it is applied to an extraordinary assembly of parliament, or the estates of the realm, held without the king's writ. Such were the convention parliament which restored Charles II. and the convention of the estates which, in 1688, declared the abdication of James II. and the right of succession on King William and Queen Mary.

CONVERGING, or CONVERGENT LINES, a term in geometry, which signifies such lines as continually approach to one another; and converging rays is a term in optics, denoting those rays that proceed from different points of an object, and incline towards another point, till at last they meet and cross each other, and then become diverging rays; and converging series is a series of terms, or quantities, that always decrease the farther they proceed, or which tend to a certain magnitude or limit, in opposition to diverging series, or such as become continually larger and larger.

CONVEYANCE, a law term, denoting a deed or instrument by which property is transferred from one person to another; and conveyancing is the art of framing and executing such legal deeds or instruments, according to certain prescribed forms, so that the property may be regularly transferred and secured to the purchaser.

CONVOLVULUS, BINDWEED, a genus of plants belonging to the Pentandria class.

CONUS, the CONE-SHELL, a genus of shells belonging to the order of univalves, some of the species of which are greatly esteemed for their beauty and rarity, and have been purchased at most extraordinary prices by zealous collectors. See CONCHOLOGY.

CONWAY, or ABERCONWAY, a town of Caernarvonshire in North Wales, stands at the mouth of a river of the same name, contains scarcely 1000 inhabitants, and had formerly some trade, but its commercial intercourse is now inconsiderable.

CONYZA, FLEA-BANE, a genus of plants belonging to the Syngenesia class.

COOK, JAMES, one of the most distinguished of our modern navigators and discoverers, was born on the 27th October 1728, at the humble village of Marton, in the North-riding of Yorkshire. His parentage was poor and lowly, his father being in the menial situation of a farm-servant, and he himself probably passed some of his boyish years in rural occupations. He acquired the first rudiments of education at a dame-school in his native village, and was afterwards sent to a day-school at Ayton, where he learned writing and arithmetic. At the age of 13 he was bound apprentice to a shopkeeper at Whitby; but as he soon shewed a decided predilection to a seafaring life, his master was induced to give up his indentures, and young Cook bound himself for seven years to Messrs Walker, considerable ship-owners in the coal-trade. In this service he continued till 1755, having in the latter years risen to the office of mate.

The coasting coal-trade has always been regarded as the best seminary for British seamen; and never was there a better illustration of this position than was afforded by Mr Cook. The experience acquired during so many years on a rocky and dangerous coast, made him a thorough *seaman*; though it does not appear that he had as yet gained those mental endowments which could qualify him for his future character of a scientific *navigator*. In 1755, in consequence of a hot press on the river Thames, from the effects of which his situation as mate did not exempt him, he thought it best to render voluntary what might have been forced on him, and entered as a seaman in the British navy. The ship of whose company he now formed a part, was commanded by captain, afterwards Sir Hugh Palliser; and this officer was induced, not only from his own observation, but from the strong recommendation of Cook's friends in Yorkshire, to take a lively interest in his welfare. By means of this powerful patronage, he was, in 1759, appointed master of the Mercury sloop of war, which then formed part of the squadron employed in Wolfe's expedition against Quebec. On this station he distinguished himself, by making two accurate surveys of the river St Lawrence, and was soon promoted to the Northumberland man-of-war, then flag-ship on the Halifax station. Having now considerable leisure, he applied himself with ardour to the study of geometry and astronomy; and when his ship was ordered to Newfoundland, he had an opportunity of acquiring fresh celebrity, by making an able survey of the harbour of Placentia. In 1762 he returned to England and married; and in 1764, when his friend, Sir Hugh Palliser, was sent to Newfoundland, he accompanied that officer in the honourable capacity of marine-surveyor. In this situation he remained till 1767, when he rendered himself conspicuous as an astronomical observer, by a paper which he communicated to the Royal society of London, on an eclipse of the sun which he had observed while in North America.

About this time the Royal society had become extremely desirous that the approaching transit of Venus over the sun's disk should be accurately observed in a southern latitude; and Captain Wallis, who had lately returned from Otaheite, had proposed that island as a suitable station for the purpose. But some difficulty arose in fixing on a person who was every way qualified to superintend such an expedition; till at length the secretary of the Admiralty, probably at the suggestion of Sir Hugh Palliser, recommended Mr Cook, a choice which met the approbation both of the board of Admiralty and the Royal society. Accordingly, being promoted to the rank of lieutenant in the navy, he was, in 1768, appointed to the command of the Endeavour; Mr Green, astronomer, was associated with him; and he was also accompanied by Mr, now Sir Joseph Banks, and Dr Solander, an eminent naturalist.

It would be inconsistent with the plan of this biographical sketch to trace the several voyages of our celebrated navigator, any farther than relates to his individual conduct and adventures, which serve to illustrate his general character.

Mr Cook sailed from Plymouth on the 26th August 1768; and having recruited his stock of water and provisions at Madeira and Rio Janeiro, doubled cape Horn, and examined the country and inhabitants of Terra del Fuego, arrived at Otaheite on the 13th April 1769. Here he framed a set of regulations that do equal credit to his judgment and humanity, for the direction of his crew's conduct towards the natives, though it required all his prudence and circumspection to avoid serious disputes, and prevent the desertion of his men. Having executed the commission entrusted to him, with the greatest ability, and under very favourable circumstances, he left Otaheite on the 13th of July, and, after visiting the other Society isles, he steered for New Zealand, which he reached on the 6th of October. Our navigator was determined, if possible, to ascertain the boundary and extent of this country, which it was supposed formed part of the great southern continent, and stretched towards the south pole. After six months strict and accurate examination of New Zealand, in which duty he was exposed to continual danger from the ferocity of the natives and the rocky nature of the coast he was exploring, he had the satisfaction to discover that this land formed two considerable islands, separated by a navigable strait. Leaving New Zealand, he arrived at New Holland on the 19th of April 1770; passed some time in examining its eastern coast, and was in the most imminent danger of shipwreck on a reef of coral rocks, from which he escaped with the greatest difficulty. He now ascertained that New Guinea was an island distinct from New Holland, and a most inhospitable country. He touched at Batavia to refit; there he lost several of his crew by sickness. This first voyage was completed on the 12th of June 1771, when Mr Cook returned to England.

The advantages which navigation and natural science derived from Cook's first voyage were readily acknowledged, and his merits were duly appreciated, both by his sovereign and the learned body under whose auspices he had acted. An account of the voyage, drawn up by Dr Hawkesworth, from the journal of the commander and the papers of Mr

Banks, had an extensive sale, and Lieutenant Cook was raised to the rank of commander in the royal navy.

Soon after Cook's return to England, an expedition was projected by the Earl of Sandwich and other eminent persons at the head of the Admiralty, for deciding the controverted question respecting the existence of a *southern* continent, and Captain Cook was appointed to the command of two vessels, the Resolution and the Adventure, which were fitted out for this important service. His instructions were, to examine minutely the expanse of the great southern ocean, and to reach as high a southern latitude as possible. He left Plymouth on this second voyage, on the 13th of July 1772, and touched first at the Cape de Verd islands, and afterwards at the Cape of Good Hope, to complete his stock of provisions and presents for the inhabitants of the South sea Islands. He sailed from the Cape on the 22d of November, and stretched towards the south as far as 67°, and, on the 25th of March 1773, arrived at New Zealand, where he found the natives more disposed to be friendly than on his former visit. In August the expedition reached Otaheite, after having been in the utmost danger of shipwreck not far from that island. Our navigator took this opportunity of still farther exploring the Society islands and some others in the neighbouring seas, and he again touched at New Zealand, previous to his making a more diligent search for land in the Antarctic ocean; but finding that, from the immense quantity of ice in that region, he could not reach a higher latitude then 71° 10′, he abandoned the enterprise for that season, and returned once more to New Zealand to refresh his crew. Here he remained till the 10th of November, when he made another attempt, not to reach a very high southern latitude, which his former experience had proved to be impracticable, but to examine certain islands which were said to have been discovered by former navigators, and make new discoveries of his own. In both these designs he was this time unsuccessful, till he arrived, in the middle of December, at Terra del Fuego; and in January 1775, he discovered a small barren island, to which he gave the name of Georgia. Having now spent above two years in traversing seas that afforded little to interest the navigator or the naturalist, he shaped his course for England by the Cape of Good Hope, and arrived at Spithead on the 30th of July 1775, after an absence of three years.

Although it must be confessed that in this voyage Captain Cook added little to our stock of geographical information, having only discovered New Caledonia, Norfolk island, and some others of less importance, yet his labours were not without their use to posterity. He had set at rest, probably for ever, the mighty question of a southern continent, or at least had proved that, if such a continent existed, it was altogether inaccessible; he had improved our knowledge of the manners and customs of the South-sea islanders; and, what is of infinitely more consequence, he proved that a ship's crew may, by proper management, be kept at sea for many months without being materially lessened or disabled by disease. He communicated the result of his regulations for preserving the health of seamen to the Royal society, of which he was elected a member soon after his return; and they have laid the foundation of a system, by which scurvy, formerly so much dreaded as the greatest foe to naval operations, is now nearly banished from our fleets.

To recompense Cook for his eminent services, the king raised him to the rank of post-captain, and conferred on him the lucrative situation of captain of Greenwich-hospital. It was now expected that, after so many toils and perils, he would be permitted to pass the remainder of his life in the bosom of his family; but such was the ardour of his mind, and so great was his desire of being useful to posterity, that he was once more tempted to forego the pleasures of a quiet and domestic life, and encounter the difficulties and the dangers of another circumnavigation.

It had alway been an object of importance to the commercial states of Europe, to find out a shorter navigation to India than by the circuitous and often dangerous route of the Cape of Good Hope. It was not, however, till long after the discovery of America that the idea of a North-west passage between the Atlantic and Pacific oceans might be discovered across or around that continent, was suggested. The Russians had proved that the continents of Asia and America were separated from each other, and it was supposed that some outlet from the extensive bays on the eastern coast of North America might be detected leading into the Pacific ocean. In 1776 it was determined by the Admiralty, that two expeditions should be set on foot to investigate this point. One of these was to examine the eastern and the other the western shores of North America, and as the latter was the more difficult undertaking, it was wished that Captain Cook should have the superintendence of it. He soon volunteered his services on this occasion, and two ships, the Resolution and Discovery, were fitted out, and put under his command. He himself in the Resolution, sailed from Plymouth on the 12th of July 1776, and on the 1st of August touched at Santa Cruz in the island of Teneriffe. He reached the Cape of Good Hope on the 18th of October, and remained till the 3d of December, taking in provisions and live-stock for the use of the South sea Islands, which it was his intention to revisit. He arrived on the coast of New Holland on the 26th of January 1777, and on the 12th of February entered Queen Charlotte's sound in New Zealand. Following the plan of his former voyages, he again examined the great South sea, and discovered a numerous groupe of well inhabited islands, to which he gave the name of the Sandwich isles. After staying some months in these seas, he directed his course to the western coast of North America, which he made on the 7th March 1778, and entered Nootka sound, where the ships were refitted. From this place, nearly in the latitude of 50° north, he ran along the coast, examining every inlet, but without finding any that entered very deeply inland. There was one, indeed, near the peninsula of Alayska, which appeared to promise fair, and which Captain Cook took for the mouth of a large river, and it has since been called Cook's inlet; but after exploring the western coast for above 3500 miles, as far as N. Lat. 70°, without finding any opening that could justify the supposition of a passage being practicable across the continent of North America, he returned towards the south, and on the 26th of November revisited the Sandwich islands, and discovered Owhyhee, the largest and best inhabited of the groupe.

In his former visit, Captain Cook had been much pleased with the natives of these islands, and he now found their character more interesting and amiable than that of any of the South sea islanders he had met with, except the inhabitants of the Society isles; and as they seemed to have formed a very exalted opinion of him and his officers, the best understanding prevailed between them from the end of November 1778 to the beginning of February 1779, at which time Captain Cook was preparing again to explore the western coast of America, and sailed from Owhyhee in prosecution of his object. But he had not long left that harbour when the Resolution sprung her foremast, and he was compelled to return. How great was his surprise to find the conduct and behaviour of the natives in their renewed intercourse completely the reverse of what he had a few days before experienced! The covetous spirit of the barbarous inhabitants, roused by the numerous objects of utility or ornament which they had lately seen, now broke forth among them with uncontroulable force, and repeated acts of theft and plunder alarmed the vigilance, and excited the indignation, of our commander. In his exertions to chastise the audacity of these rapacious islanders, he unfortunately ventured on shore without a sufficient guard, and was soon surrounded by a numerous party of the natives. In vain did he exercise the courage and presence of mind for which he was so remarkable; in vain did his boats now attempt to protect him; borne down by overwhelming multitudes, stunned by the blow of a club, and severely wounded by a spear, he fell into the water, and was speedily dispatched by the daggers of his savage assailants. His bones only were recovered, and committed to the deep, amid the tears and lamentations of his officers and crew.

In person Captain Cook was tall and robust, with expressive features, but with a thoughtful and rather austere countenance. His manners and address were plain but manly; his temper inclined to be hasty and authoritative, though in his natural disposition he was humane and benevolent. As a commander he was strict and peremptory, bold and vigilant; inured to hardships from his earliest years, he bore hunger and fatigue with firmness, and encountered danger with intrepidity. As a writer, in which capacity he more than once appeared before the public, he was simple and perspicuous, but of course professional. His second voyage, and his papers in the Philosophical Transactions, are highly respectable, though not remarkable for correctness or elegance of style.

When the news of his death reached England, the king settled a pension of L.200 per annum on his widow, and L.25 per annum on each of his three sons, who were also provided for in his majesty's service, and, like their father, sacrificed their lives on the altar of their country.

COOKERY, the art of preparing and dressing food. See DIETÆTICS.

COOPER, ANTHONY ASHLEY, third earl of Shaftsbury, and an eminent author, was born in London in the year 1671. Of his father no memorial has been rescued from oblivion, either in the records of his family or of his country, except that he was the son of the first earl of Shaftsbury, and that he bore the title after that celebrated statesman's decease. The young heir of the family became from his birth the object of his grandfather's tender regard, who undertook the care of his education; and with a view of imbuing his mind from his infancy with a knowledge of the languages of antiquity he placed him under the charge of a Mrs Birch, who had acquired from her father, a schoolmaster, a thorough knowledge of Greek and Latin, so as not only to read the authors with ease, but to speak their language with fluency; and such, it is said, was the effect of her instructions on the mind of her toward pupil, that, by the time he had attained his eleventh year, he was well versed both in Grecian and Roman literature, for which he retained a strong predilection during the whole of his life. He was placed first at a private school, and afterwards at that of Winchester, where, on account of his grandfather's political principles, he was insultingly treated by the scholars, and at his own request he was permitted to leave the school, and to commence his travels. From the year 1686 to 1689 he traversed the continent, under the care of Mr Daniel Denovan, a Scotch gentleman every way well qualified for the employment of a tutor.

On his return from abroad he was offered a seat in the House of Commons, which, as it would interfere with the plans of study he had determined to prosecute, he possessed resolution to decline. Five years afterwards, however, he came into the house as one of the representatives of the borough of Poole, in Dorsetshire. Soon after his election the bill for regulating trials for high treason, which proposed to deprive persons accused of this crime of the benefit of pleading their cause by counsel, came under discussion, on which Lord Ashley delivered his maiden speech. But though he had well considered the subject of debate in private, he was so overawed when he rose to speak by the augustness of the audience, and the novelty of his situation, that he was unable to proceed. But being encouraged by the indulgence of the house, he not only regained his self-possession, but turned his embarrassment to good account, by referring it to the question under consideration. "If, Mr Speaker," said he, "I who rise only to give my opinion on the bill now depending, am so confounded that I am unable to express the least of what I proposed to say, what must the condition of that man be, who, without any assistance, is pleading for his life, and under apprehension of being deprived of it?" an appeal which made a most favourable impression on the house.

The delicate state of his health forbade him to take that active share in public affairs to which his rank and his talents gave him the right and the qualifications. After the year 1698 he returned to a private capacity, engaged in literary pursuits, and in the character of a student of physic spent a considerable portion of his time in Holland, associating with Bayle, Le Clerc, and other men of letters. As Bayle was not aware of his real designation, he took the following method to let him into the secret: He caused a common friend to ask him to dinner with the view of introducing him to Lord Ashley. The morning of the day on which this engagement was to be fulfilled, Bayle called on Lord Ashley, who pressed him to stay; that is impossible, said Bayle, for I have a positive appointment to meet with Lord Ashley at dinner. The incident of course created a great deal of harmless mirth, and the discovery strengthened their mutual friendship.

On the death of his father, in 1690, he succeeded to the peerage, but did not begin to attend the house of Lords till Lord Somers acquainted him of the necessity of his presence during the discussion of the partition treaty. He continued to support the measures of King William's government till the demise of that prince; and on the accession of Queen Anne he finally relinquished public affairs, and betook himself again to literary and philosophical enquiries. In 1703 he made a second visit to Holland; and in 1708 he commenced his career as an author. His first publication was his *Letters concerning Enthusiasm*, which was followed by his *Moralist, a Philosophical Rhapsody*, his *Sensus Communis*, and his *Essay on Freedom, Wit, and Humour*. In 1709 he married a Miss Ewer, not for love or interest, but, as he said, to oblige his friends, who thought his family worth preserving. This indifference to the matrimonial state is said to have been occasioned by a previous disappointment in love. In 1710 his Soliloquy, or Advice to an Author, was published in London; and in 1711, after taking leave of his friends by letters, some of which were afterwards published, he went in quest of health through France to Italy, where he died in 1713, at the premature age of forty-two. In Italy he prepared his Judgment of Hercules, and his letter concerning Design. His Characteristics of men, manners, opinions, and times, had been published in 1711, but was in Italy carefully revised and corrected, and after his death again given to the world, accompanied with prints designed by himself, and executed under his inspection. Five years afterwards appeared his Letters to Lord Molesworth, which completes the list of his writings.

Shaftsbury has the reputation of having been a man of temperance, integrity, and patriotism. His classical attainments were very extensive, as, from his childhood to the time of his death, he delighted in the perusal of the Grecian and Roman authors. His scepticism, in regard to the Christian religion, is known to all who are conversant with his works. His style has been praised for its elegance by one set of critics, and blamed for its laborious stiffness by another set. He left a brother behind him, who translated Xenophon's Institution of Cyrus into English, and a son, who succeeded to his titles.

COPAIFERA, a genus of plants belonging to the Decandria class, one species of which furnishes a balsam employed in the Materia Medica.

COPAL, a gum resin, the concrete juice of *rhus copallinum*, a plant which is a native of South America. Copal is much employed as a varnish. See Chemistry and Varnishing.

COPENHAGEN, the metropolis of Denmark, stands on a small promontory on the eastern coast of the isle of Zealand, is reckoned one of the finest cities in the north of Europe, is about five miles in circumference, and fortified both towards the land and the sea side. It is divided into the old and new town, and Christianshafen, on the island of Amack, with which a communication is formed by means of bridges. The streets are generally broad and well paved, and some of them are intersected by canals, which afford many facilities to commercial enterprize.

The principal public buildings, as the university, the royal college, several churches and hospitals, as well as the dock, are in the old town, which lies on the north side of the harbour. The ruins of the palace of Christiansburg, which was destroyed by a dreadful conflagration in 1794, still afford sufficient evidence of the splendour and magnificence of that edifice. The royal museum, which is arranged in eight different apartments, still occupies a wing of the building, which fortunately escaped the ravages of the flames. Among the edifices in this quarter of the city is situated the observatory, a remarkable structure, erected by Frederick V. for a disciple of Tycho Brahe. This building is of a cylindrical form, 70 feet in diameter, and 130 feet in height, and is furnished with a spiral carriage road of brick, which reaches within 20 feet of the summit, from which the finest view of the city and surrounding country is obtained.

The new town is composed of an octagon, and four spacious streets which lead to it in opposite directions; the octagon itself consists of four elegant palaces, having each two wings. One of the palaces is the residence of the king, two others are occupied by other branches of the royal family, and the fourth is employed as a seminary for the instruction of young men destined for the naval service; at the extremity of one of the streets stands Frederick's church, which has long remained unfinished. This noble edifice is constructed of polished Norwegian marble, and promises, when completed, to be one of the most magnificent buildings that adorns any capital. The palace of Rosenberg, near the north gate, is said to have been designed by the celebrated Inigo Jones; the king holds his annual bed of justice in its apartments, and the inhabitants of the city are permitted to walk in its extensive gardens.

Christianshafen stands on the island of Amack, from which Copenhagen is supplied with the produce of the garden and the dairy, and is connected with the old city by means of two bridges. The dock-yards for repairing and refitting ships of war, and the marine arsenal, are in this part of the city. The harbour of Copenhagen is so spacious that it is capable of receiving 500 ships, and is completely secured by the fortifications. The entrance, which is protected by the citadel and the batteries, is so narrow that a single ship only can approach at a time. Ships of the line are moored in the centre of the city, and merchant vessels are conducted along the canals close to the warehouses where they discharge their cargoes.

The population of Copenhagen, which, in 1799, was stated at 82,000, had increased in 1806 to 95,000, but it is supposed now to fall short of that number. The principal manufactures are woollen and silk stuffs, porcelain, and calico printing. Copenhagen formerly enjoyed a very extensive trade with the East Indies, and with the Danish colonies in the West Indies; but of the former no trace remains, and the latter has greatly declined. The trade with its European settlements, and with other European nations, is considerable.

Numerous charitable and literary institutions have been established in Copenhagen. The royal academy of Sciences, instituted in 1743, has published 15 volumes of Transactions; besides which are the royal Economical society for the encouragement of agriculture, fisheries, and the fine arts; the Medical society, the society for Icelandic literature, and a board of Longitude. The royal library, consisting of nearly 300,000 volumes, is enriched with manuscript and printed editions of the classics, beside a considerable collection of Icelandic manuscripts. The university was founded in 1479, consists of four colleges, which are well endowed, and is usually attended by 500 or 600 students.

Copenhagen has been severely visited by the calamities of war and fire. In 1728 not fewer than 1650 dwelling-houses, with four churches, the university, and some other public edifices, were reduced to ashes; and in 1794 nearly 1000 buildings, among which were the palace of Christiansburg and the church of St Nicholas, were destroyed by a similar conflagration. In the year 1807, when the Danes refused to surrender their fleet, which was about to be transferred to the French, Copenhagen was subjected to a dreadful calamity, when it was besieged and bombarded by the British troops by sea and land. The cathedral and more than 300 houses were completely destroyed, double the number was greatly injured, and 600 persons are said to have perished during the time that active hostilities continued.

COPERNICUS, Nicholas, a distinguished astronomer, who had the merit of reviving the true system of the world, was a native of Thorn in Prussia, was born in 1473, received the early part of his education in his native place, and having studied physic at the university of Cracow, was admitted to a medical degree. Having a strong bias to mathematical studies, he was led to cultivate the kindred science of astronomy; and, with this view, it is said, he visited Italy in his 23d year, for the purpose of attending the lectures of Dominic Maria, professor of mathematics at Bologna. The variability of the axis of the globe which Maria had assumed as a hypothesis, it is supposed, first suggested to Copernicus the idea of explaining the phenomena of the heavens by the motion of the earth.

Proceeding to Rome, Copernicus employed himself in teaching mathematics, and in making astronomical observations, and such was the reputation which he had acquired, that on his return to his native country, he was consulted by the Roman clergy on the reformation of the calendar. Soon after his return to Prussia, he was admitted to the clerical profession, and enjoyed two benefices, the residence attached to one of which, from its situation, was peculiarly favourable for astronomical observations.

About the year 1507, Copernicus, it is supposed, first began to form the system which has been since distinguished by his name, and which he finally established by a long train of observations which he pursued for many years, and came to the final conclusion, that the sun is the centre of motion to the planetary system, instead of the opposite opinion of the immobility of the earth and of the sun and planets revolving round it as their centre. The work of Copernicus, in which the truth of his system is confirmed and illustrated, was printed at Nuremberg in 1543. But the author terminated his mortal career a few hours after a copy of it was put into his hands, and when he had reached the 70th year of his age.

COPHTS, or Copts, are descendants of the ancient Egyptians, who profess the Christian faith, and belong to the Jacobite or Eutychian sect. The name is supposed to be derived from an ancient town of Egypt, while others think that it was given by way of reproach by the Mahometans. The patriarch of this church resides at Alexandria and is said to have more than 100 bishops in Egypt, Syria, and other countries subject to his authority. Eutychius, the patriarch of Alexandria, first maintained the doctrine of one nature in Christ; and in general the rites and doctrines of the Coptic church are similar to those of Abyssinia.

COPPER, a metallic substance; for the properties of which see Chemistry, and for an account of its ores see Geology.

COPYHOLD is a kind of tenure by which land is possessed in England; and is so called because the tenant holds his lands by copy of court-roll of the manor; and it is denominated a base tenure, because the property is held at the will of the lord. See *Blackstone's Commentaries*.

COQUIMBO, or La Serena, the capital of a province of the same name in Chili, which was founded by Valdivia in 1544. It is finely situated about a quarter of a league from the sea; has spacious streets crossing each other, and forming squares of buildings; the spaces between are occupied as gardens; and the houses are constructed of mud and covered with leaves. The principal buildings are the parish churches, five convents, the college, and the town-house. The town is supplied with water by means of canals; and there is a safe bay for ships at the mouth of the river. The population in the time of Ulloa was stated at 500 families.

CORAL, a marine production, the work of animalcules, and of which some species, as the red coral, are in great request for ornamental purposes. The principal coral fisheries which furnish Europe with this substance are near Marseilles, the Lipari islands, the straits of Messina, and other places in the Mediterranean, particularly on some parts of the African coast. From the natural history of this substance, it would appear that the coral is chiefly found in caverns or grottoes, from some of which, at the depth of 60, 100, and sometimes 900 feet, it is brought up by means of different implements. After a cavern has been deprived of its crop of coral, a certain interval must elapse before it can be reproduced, and it is supposed that it is renewed in a shorter time in places comparatively shallow than at great depths; this difference is probably owing to the higher temperature at moderate depths. It is said that it reaches the same size in ten years, when the depth is only 60 feet, which would require 40 years at the depth of 900 feet. See HELMINTHOLOGY, and for an account of the coral fishery see Spallanzani's *Travels in the two Sicilies.*

CORCHORUS, BROOM-WEED, or JEWS-MALLOW, a genus of plants belonging to the Polyandria class, and of which *Corchorus Japonicus*, a native of Japan, as the name indicates, is now well known in the flower garden by its fine double blossoms.

CORCYRA, the ancient name of the island of Corfu in the Ionian sea, and celebrated in classical history for the shipwreck of Ulysses and the gardens of Alcinous.

CORDAGE, a general denomination for all kinds of rope or cord, and especially for such as are employed for the rigging or cables of ships. See ROPE-MAKING.

CORDIA, SEBESTEN PLUM, a genus of plants belonging to the Pentandria class.

CORDOVA, the ancient *Corduba*, a city of the province of Andalusia in Spain, occupies a delightful spot on the north bank of the Guadalquiver, is of a square form, and defended by walls which are washed by the river. This city covers a large space of ground, the different quarters of which are separated by extensive gardens and orchards; the streets are generally narrow and crooked, but the principal square includes a spacious area, and is adorned with regularly built houses. The cathedral, formerly a mosque, is one of the principal public edifices, of immense magnitude, and placed in a conspicuous station at the meeting of four streets. Some of the other churches, as well as the Episcopal palace and the college of St Paul, are elegant structures, and some of them are adorned with valuable paintings.

The population of Cordova, which, in the time of the Moors, is said to have been equal to 300,000, is now reduced to about 35,000. While the Moors occupied Spain, Cordova was celebrated for its manufactures of silk and gold-lace, as well as for a considerable trade. The chief manufactures are ribbons, lace, baize, and hats, with some works in gold and silver. The manufacture of the leather which derives its name from this place is very limited. The surrounding territory enjoys a fine climate, and even the rugged mountains are clothed with gardens, vineyards, and forests of olive, orange, citron, and other fruit-trees.

CORDUROY. See CLOTH MANUFACTURE.

COREA, or KOREA, a large peninsula of Asia, interposed between the Japanese and the Yellow sea, with a fringe of fertile and populous islands around its shore; is situated between the 34° and the 38° of north latitude, and the 124° and the 130° of east longitude, and forms one of the tributary kingdoms of the Chinese empire. The state of the interior is known only from the accounts of the Chinese historians inserted among the collections of Duhalde and Grosier, and the narratives of some shipwrecked Dutch sailors, detained there several years as prisoners; but the state of the coast is ascertained from the more accurate information of the French navigator La Perouse, and of our own countrymen, Mr M'Leod and Captain Hall.

From the first of these sources of information we learn, that the interior of the country exhibits a very irregular and broken surface, highly elevated in some places, and as deeply depressed in others; the rivers by which it is watered flow from the *ever white mountains*, a name derived from their being constantly covered with snow; these rivers are the Ya-lan, on the north-west; the Tou-men, on the north-east; the Li on the west; and the Han on the south-east; which, with numerous smaller streams, wind their way through richly diversified and highly fertile regions, clothed with timber-trees, rich pastures, grain, gin-seng, cotton, and tobacco. From the interior of the mountains are obtained gold, silver, iron, and salt; the horses of the country are a very diminutive but hardy breed, and the poultry is of a peculiar kind, with uncommonly long tails, perhaps a species of pheasant. The inhabitants are robust and well proportioned, exhibiting proofs of Tartar origin; but they are much addicted to the imitation of Chinese manners, and the study of Chinese learning; the women have more freedom than in China, and the men are brave, and make excellent soldiers; they do not inter their dead till three years after their decease, and place in or around the tomb their clothes, and every thing else of which they had been particularly fond during their lives. The kingdom is divided into eight provinces, and contains 33 cities of the first, 58 of the second, and 70 of the third order, built and defended like those of China, consisting of one story high houses, constructed of brick, or mud covered with straw, and inclosed by a high wall, with square towers, battlements, and arched gateways. King-ki-tao, situated towards the centre of the kingdom is the capital; the inhabitants are employed in agricultural pursuits, in fishing, and in the manufacture of paper, paint-brushes, and in a variety of other useful articles; and they carry on a considerable trade by the way of barter with China and the rest of their neighbours.

From La Perouse we learn, that the southern coast is, for the distance of three or four miles from the shore, thickly strewed with rocks and islands, which render navigation dangerous; and that the eastern coast is more free from insular interruption, with deeper and smoother water, by which he was enabled to steer his course close to the shore, where he observed high and barren looking mountains, covered here and there with patches of snow so late in the season as May, and surmounted by numerous fortifications; and where he also observed many bays and inlets, surrounded by houses and towns, and occasionally studded with vessels, resembling in all respects Chinese junks.

But the most recent, though still unsatisfactory account of Corea, is derived from the lately published voyages of Mr M'Leod, and Captain Hall, who, first of European navigators, examined its western coast. Departing, towards the end of August 1816, from the gulf of Pe-che-lee in China, in the Alceste and the Lyra, under the command of Captain Maxwell, who had carried out Lord Amherst, the British embassador to the court of China, they sailed on their way to the island of Loo-choo, for more than 300 miles along the western coast of Corea. The whole of this coast is so full of islands of different

Corea.

sizes, that in most places upwards of a hundred were visible at once, the greater part of which is extremely populous. The first group at which they anchored, they named Sir James Hall's islands, where they found the land considerably elevated above the water, and covered in some places with brushwood, short soft grass, and sweet-scented shrubs; and in other places cultivated with millet, buck-wheat, a kind of bean, and tobacco; the houses collected into villages, built of reeds, plastered with mud, and badly thatched with straw. The inhabitants whom they saw were of a deep copper colour; of a forbidding and somewhat savage appearance. The superior sort were distinguished by hats with brims three feet in diameter, and crowns nine inches high, shaped like a sugar-loaf with the top cut off. The texture of these hats is of open work, like the wing of the dragon-fly, and they appear to be made of horse-hair varnished over. The common dress consisted of wide trowsers, and a sort of frock reaching to the knee, of a coarse open grass cloth, with neat straw sandals on the feet. The women were seen beating rice in wooden mortars, with children tied on their backs. Both sexes are of the middle size, remarkably well made, and robust looking; and the only strong emotion which they expressed was to get rid of their visitors, with whom they shewed the greatest reluctance to have any kind of intercourse, and with whom they used a variety of endeavours to induce them to depart.

Their next landing was on Hutton's island, situated 36° 10′ north latitude, and 126° 15′ east longitude, among a numerous group. The inhabitants of this island crowded about them, addressed them in loud and long speeches. They wore loose flowing robes and cloth shoes; their hair was long, and by some of them it was fastened in a conical knot on the crown of the head. On the 4th of September they came to anchor in Basil's bay, which runs up into the main-land, is about four miles across, skirted by large villages built among trees, and surrounded by cultivated districts, forming altogether a scene of considerable beauty. Before they had time to land, a large party of the natives, in numerous canoes, came off from shore towards the ships. In one of the canoes was "a fine patriarchal figure seated under an umbrella; his full white beard covered his breast, and reached below his middle; his robe or mantle, which was of blue silk, and of an immense size, flowed about him in a magnificent style. His sword was suspended from his waist by a small belt; but the insignia of his office seemed to be a slender black rod tipped with silver, about a foot and a-half long, with a small leather thong at one end and a piece of black crape tied to the other. This he held in his hand. His hat exceeded in breadth of brim any thing the visitors had seen, being, as was supposed, nearly 3 feet across." The want of an interpreter rendered every attempt at intercourse abortive; long speeches and letters in the Corean and the English languages were exchanged to no purpose between the natives and the strangers. In the absence of other means of communication, recourse was had to motions of the hand and gesticulations of the body, which, being a sort of natural language, are universally understood. The chief and his attendants entered the ships, examined every thing, and was in good humour, except in the capriciousness of his temper and conduct toward his own men. Next day, after the chief and his people had been several times on board, had measured the ships, and seen almost every thing they contained, Captain Maxwell and his companions prepared in their turn to go on shore. This design, however, as soon as it was discovered, met with every discouragement; the old man drew his hand across his throat, to shew his unwelcome visitors, that if they persisted, his life would be the forfeit; and at last, on their actually having effected a landing he wept, and even bellowed aloud, frequently at the same time drawing his hands across his throat, and then wringing them, as if washing them in his blood. After they had tried many methods of appeasing the old chief without success, they, in less than an hour, were under the necessity of quitting this inhospitable shore, without having been twenty yards from their boats. They saw the village, however, to some advantage; it is neatly built and very pleasantly situated under fine trees, in a valley cultivated like a garden, in small square patches. The old agitated chief paid Captain Maxwell a parting visit, and received from him a present of a bible.

At another of these islands they landed on the 8th September, where they saw women dressed in a long white robe, open in front, with a petticoat of the same colour reaching a little below the knee; their hair was tied in a large knot behind, and a small piece of cloth was thrown loosely over the head to protect them from the rays of the sun. They had fairer complexions than the men; and had children on their backs, or in their arms. Others, with only the under part of the body covered, were employed in winnowing and husking rice. The British entered a deserted house, where they found heaps of corn and straw, cooking utensils lying about, and fishing-lines coiled in baskets. The inside was dark and uncomfortable; the mud-floor was full of hollow places; the walls looked black with soot, and every thing looked dirty. The fire-place was between two boilers, sunk in brick-work. Bowls and dishes of earthen-ware and bell-metal were numerous and arranged in shelves. The villages are built in the vallies of these islands, where the houses are nearly hid by trees and hedges. The sides of the hills are cultivated with millet and a species of bean; and in the gardens near the villages is a great variety of plants. Bullocks of a small breed, and dogs, were the only quadrupeds which were observed. Crows are as common there as in the other parts of the world; pigeons, hawks and eagles, are also seen, but few small birds. Neither temples, idols, nor tombs, as in the Chinese villages, are to be met with in the islands on the coast of Corea. The geological specimens collected in these islands were, compact stratified pale, pink limestone, variegated in colour; strata highly inclined; very compact slaty grey rock, strata inclined at an angle of 75°, dipping towards the north-east; dark olive steatitic rock, containing fragments of granular marble; very fine grained hornblende rock; fine grained purplish slate, the strata highly inclined; greenish-grey slate, containing crystals of white feldspar, and marks of hornblende strata highly inclined, dipping towards the north-east.

Corelli.

CORELLI, Arcangelo, one of the most celebrated musicians and composers of the Italian school, was born near Imola in the territory of Bologna, in February 1653. His first instructor in counterpoint was *Simonelli* of the papal chapel, "who," says a contemporary writer, "made many scholars, among whom the most celebrated was the famous Corelli, the chief glory of the age;" and his masters on the violin, the instrument which he cultivated so successfully, were *Laurenti* and *Giambattista Bassani* of Bologna. The latter of these was both an excellent performer, and in high repute as a composer. Dr Burney, speaking of him, says, "Indeed his sonatas for the violin, and his accompaniments for that instrument to his masses, motets, psalms, and cantatas, manifest a knowledge of the finger-board and bow, which appears in the works of no other composer anterior to Corelli which I have been able to find; and the lovers of the pure harmony and simple melody of that admirable master, would still receive great pleasure from the performance of Bassani's sonatas for two violins and a base; in which they would hear, not only the general musical language of the time, but the mild accents and particular tones of Corelli's own mellifluous voice." Corelli is reported, but without satisfactory evidence, to have visited Paris in 1672, and, notwithstanding his talents and tranquil character, to have been driven thence by the violent behaviour of the famous Lulli, at that time the musical autocrat of the French court, who could not endure the presence of a person so qualified to rival him in public estimation. It is more certain that he visited Germany after finishing his studies, and that he was engaged for a short time in the service of the duke of Bavaria. On quitting this he returned to Italy, and resided at Rome, where, about 1683, he published his first *Twelve Sonatas*. A second set appeared there in 1685, under the title of *Balletti da Camera*; a third in 1690; and the fourth, with the same title as the second, about four years afterwards. He was at this period the leader of the band on public occasions; and his performance on the violin was the theme of praise among musicians throughout Europe. He was highly fortunate in having Cardinal Ottoboni for a patron, in whose palace he resided; and whose splendid musical parties, which were held every Monday evening, he had the honour to regulate.

The fame of Corelli, already so great, was vastly enhanced by the publication of his *Solos*, which appeared in 1700, with a dedication to Sophia Charlotte, electress of Brandenburgh. These alone are sufficient to preserve his reputation. "Corelli's solos," says the crudite historian already quoted, "as a classical book for forming the hand of a young practitioner on the violin, has ever been regarded as a most useful and valuable work by the greatest masters on that instrument. I was told by Mr Wiseman at Rome, that when he first arrived in that city, about twenty years after Corelli's decease, he was informed by several persons who had been acquainted with him, that his *Opera Quinta*, on which all good schools for the violin have been since founded, cost him three years to revise and correct. Tartini formed all his scholars on these solos; and Signor Giardini has told me, that of any two pupils of equal age and disposition, if the one was to begin his studies by Corelli, and the other by Geminiani, or any other eminent master whatever, he is sure that the first would become the best performer."

Corelli.

We are indebted to the same author for the preservation of some anecdotes respecting Corelli, obtained by a friend from the musician just named, who was one of his most illustrious scholars. The account of his appearance in the court of Naples, whither he was invited by the king in the height of his reputation, both "throws light," to use the doctor's words, "upon the comparative state of music at Naples and at Rome in Corelli's time, and exhibits a curious contrast between the fiery genius of the Neapolitans, and the meek, timid, and gentle character of Corelli, so analogous to the style of his music." He was somewhat reluctant to accept the flattering invitation, but at last consented; and, lest he should not be well accompanied, took with him his own second and violoncello. With no small difficulty he was induced to play one of his concertos (hereafter to be mentioned) before the king. His fear had been great, it seems, that justice should not be done it, as his whole band was not with him, and there was no time for a rehearsal; but, to his astonishment, the Neapolitan band performed it at sight, almost as well as his own after repeated rehearsals. Being again admitted into his majesty's presence, and requested to give one of his sonatas, he was greatly mortified by the king quitting the room during the performance of an adagio, which seemed dull and tedious to the Neapolitan monarch. "Afterwards he was desired to lead in the performance of a masque, composed by Scarlatti, which was to be executed before the king; this he undertook; but from Scarlatti's little knowledge of the violin, the part was somewhat awkward and difficult; in one place, it went up to F; and when they came to that passage Corelli failed, and was unable to execute it; but he was astonished beyond measure to hear Petrillo, the Neapolitan leader, and the other violins, perform that which had baffled his skill. A song succeeded this in C minor, which Corelli led off in C major. Let us begin again, said Scarlatti, good-naturedly. Still Corelli persisted in the major key, till Scarlatti was obliged to call out to him and set him right. So mortified was poor Corelli with this disgrace, and the general bad figure he imagined he had made at Naples, that he stole back to Rome in silence."

The concertos now alluded to, though composed several years before, were not published till 1712. These have resisted the attacks of time more successfully than any of his works. "The harmony is so pure, so rich, and so grateful," says Burney, "the parts are so clearly, judiciously, and ingeniously disposed, and the effect of the whole from a large band so majestic, solemn, and sublime, that they preclude all criticism, and make us forget that there is any other music of the same kind existing." Corelli survived their appearance only a few weeks. The dedication to the Prince-palatine of the Rhine is dated the 3d of December, and his death happened on the

18th of January following. He was interred in the church of the Pantheon near the illustrious Raphael.

A commemoration of this admirable genius was held in the Pantheon for many years after his death. It consisted in a solemn service, selected from his own works, and was performed by a numerous band on the day of his funeral. "The late Mr Wiseman, who arrived in Rome before the discontinuance of this laudable custom, assured me," says the historian, "that his works used to be performed on this occasion in a slow, firm, and distinct manner, just as they are written, without changing the passages in the way of embellishment; and this, it is probable, was the way in which Corelli himself used to play them."

Corelli was of a quiet and peaceable disposition, but abundantly tenacious of the respect due to his talents, and not a little proud of the influence and familiarity with the great which they procured him. He could not brook any inattention during his performance; and this is not surprising, if we consider the agitation and fervour which he himself experienced when thus occupied. He seems to have thought, that music without passion was nothing; and passion, when once excited, monopolizes every feeling and sentiment. It is certain that his own compositions, when well performed, are capable of absorbing the whole soul; but to do them justice requires an enthusiasm and an effort of abstraction, which neither ordinary musicians nor ordinary hearers are willing or able to bestow. The *body* of Corelli's concertos may be often met with in public assemblies, but the *spirit* can alone be expected to be enjoyed where the weighty concerns of gossipping and shewing off give place to the genius of the art. Corelli's magnanimity, it is probable, did not bear proportion to his sensibility. He is said to have shortened his life by vexation at his supposed failure before the king of Naples, and disgust at the applause bestowed on a very inferior musician who had recently become fashionable at Rome. Nor ought it to be omitted as evidence of his characteristic weakness, as well as of his temperate habits and his taste, that he bequeathed about L.6000 Sterling, and a very valuable collection of pictures, to his patron Ottoboni. "A musician leaving money to a cardinal," remarks Burney, with no little indignation, "while he had a relation or necessitous friend in the world, seems to savour more of vanity than true generosity. And the cardinal himself manifested his opinion of this bequest, by keeping only the pictures, and distributing the rest of Corelli's effects among his poor relations, to whom they naturally appertained."

As a practical musician, Corelli must be esteemed for an excellence and merit which did not cease with his own performance. He established the character of the violin beyond the probability of depreciation, by giving it a tone and expression which brought it next to the human voice, and which entitled it to the lead in concert, even before the rapidity and kind of execution attained on it since his time pointed it out as worthy of precedence and authority. In this last quality, it has already appeared, he was surpassed by some of his contemporaries; and in power and management of the bow he has been exceeded by many of his successors, in a way of which, perhaps, neither he nor any performer of his time could have entertained a conception. His works, nevertheless, have contributed to maintain the superiority of the violin, by furnishing, as we have seen, the best materials for the study and practice of young performers; and, accordingly, it has been remarked, that, after their publication, this instrument increased in favour all over Europe. In respect to composition, it is doubtful if he can claim the honour of originality, quickness of invention, variety of ideas, profound learning in musical science, extensive acquaintance with modulation, or any peculiar felicity in the creation of melodies. His equals, at least, in these qualities, could be easily enumerated among his immediate successors, and still more confidently if we extend our research to modern times. His merit seems to consist in a purity of taste, which discards every superfluous embellishment, an exquisite perception of harmony, and the uncommonly judicious arrangement of parts. He is the Virgil of the older musicians,—a model of elegance, simplicity, and good sense; and these excellencies, though far from being the most splendid, are so uniform and permanent in their effects, that, notwithstanding the thousand caprices and novelties which every generation witnesses in the art, we may safely predict the durability of his compositions whilst music shall afford delight to human nature.

COREOPSIS, tick-seed SUN-FLOWER, a genus of plants belonging to the Syngenesia class.

CORFU, the ancient *Corcyra*, an island at the mouth of the Adriatic, and near the coast of Albania; is about 60 miles in length, and at its greatest breadth about 30 miles. Corfu, with Zante, Cephalonia, and some other islands, forms the republic of the Seven Islands. See SEVEN ISLANDS.

CORIANDRUM, CORIANDER, a genus of plants belonging to the Pentandria class.

CORIARIA, Tanners or Myrtle-leaved SUMACH, a genus of plants belonging to the Diœcia class. One species of this genus, from its astringent properties, is much employed in the south of France, where it is indigenous, for tanning leather, and from this property it derives one of its trivial names. The same plant also furnishes a fine black dye.

CORINTH, one of the most celebrated cities of ancient Greece, was situated on the south part of the isthmus which joins the Peloponnesus, now known by the name of Morea, with the continent. Two maritime towns, Cenchrea on the bay of Saron, and Lecheum on the bay of Corinth, were included in the same state. This city is said to have been founded 1500 years before the Christian era, by Sisyphus, the grandfather of Ulysses, and was afterwards enlarged and adorned by Corinthus, the son of Pelops, from whom it has retained the name to modern times. The commercial enterprises of the inhabitants of Corinth raised their city to the first rank for wealth and splendour among the cities of Greece, and it continued to preserve its liberty and independence till the 146th year before the Christian era, when it was plundered and burnt by the

Romans. The Roman colony, which had settled in the city, had restored it, in some degree, to its former splendour, was doomed to yield to another conqueror, Alaric, the savage destroyer of Athens and the whole of Greece. Corinth was besieged and taken by Mahomet II. in 1549; in 1698 it was given up, along with the Morea, to the Venetian republic; and in 1715 restored to the Turks.

Corinth stands on elevated ground, beneath the Acrocorinthus, or citadel, and on a gentle declivity towards the gulf of Lepanto; is still of considerable extent; domes of mosques are seen rising among groves of cypresses; and the spaces unoccupied by houses are covered with corn-fields and gardens of orange and lemon-trees. Few monuments of the Greeks and Romans are now visible. Some fluted columns of the Doric order, much mutilated, still remain not far from the market-place. The inhabitants of Corinth are chiefly Christians of the Greek church.

CORINTHIAN ORDER. See ARCHITECTURE.

CORIS, a genus of plants belonging to the Pentandria class.

CORISPERMUM, TICKSEED, a genus of plants belonging to the Monandria class.

CORK, the bark of a tree, which is a species of oak. See BOTANY.

CORK, a county in the province of Munster, occupying the southern extremity of Ireland, is intersected by the 52d parallel of north latitude, and the 9th of east longitude; and is bounded by the Atlantic ocean on the south, by the county of Kerry on the west, and by those of Limerick, Tipperary, and Waterford on the north and east.

General aspect.—This county, measured from its extreme points, is about 90 miles in length and 55 in breadth; but taken according to its mean dimensions, it is about 60 miles by 50. The line of the coast is rendered irregular by lofty and precipitous promontories jutting far into the sea, and by bays and estuaries making wide and deep encroachments on the land. The western districts exhibit every variety of mountain scenery, from the gentle declivity to the headlong cliff, and from the extended table-land to the towering peak. The rills and torrents which descend from these mountains form and feed a number of large rivers, which glide rapidly through a country of a finely undulated outline, green with pastures, or clothed with corn; so that nothing but wood is wanting to render this region one of the pleasantest and most picturesque counties in the united empire.

Mountains and minerals.—The eastern part of the county is comparatively flat, though even there the extent of level land is extremely limited; but on proceeding westward up the river-courses, the surface is found rapidly to increase in altitude and asperity, till on the western shore of the bay of Bantry it reaches its highest degree of elevation and ruggedness. The whole line of the coast, especially towards the west, is guarded by a high and a steep barrier of rocks, which, in gloomy grandeur, frown over the stormy Atlantic, and sullenly repel its waves. Except the mountains of Boggra, which expand into an ample area of a marshy surface, the general tendency of the upland districts is from east to west in longitudinal ranges, with narrow and sharp-pointed summits. The whole length of the county from east to west, and for the breadth of 16 miles inland from the shore, constitutes what Mr Townsend denominates *the grey-stone district;* it contains huge masses of quartz, and numerous quarries of roofing-slate. What the same author calls *the red or brown-stone district*, commences about five miles south from Cork, and thence it pervades the whole of this and penetrates into some of the surrounding counties. This rock yields good flags and building-stones. In this tract are found extensive beds of limestone, inclosed generally by hills composed chiefly of quartz and argillaceous breccia. The largest of these limestone-beds is situated in the northern side of the county, and extends upwards of twenty miles in length, and in some places nearly ten in breadth; that which is next in extent occupies the vale of Cork, and is about forty miles in length and two in breadth. There are other beds of smaller dimensions, most of which, as well as the larger, yield a grey-coloured marble, interspersed with white spots and sea-shells. Coal has been found in the north-western part of the county; iron ores are common, and traces of lead and copper are observable in the limestone quarries.

Lakes, springs, rivers, and bays.--Among the mountain vallies, especially those of the baronies of Bear and Carbery, are numerous lakes of small extent, formed by the torrents and rivulets which rush from the mountains; and which, as they dash from steep to steep, exhibit chains of roaring waterfalls. Many chalybeate springs are found in the rocky districts; and the waters of Mallow, which are said to resemble those of Bristol, have acquired medicinal celebrity. The principal rivers are the Blackwater, the Lee, the Bandon, and the Ilen. The river Blackwater rises on the confines of Kerry, and flows southward till it reaches Mill-street, from which it pursues an easterly direction till it enters the county of Waterford, when it again bends towards the south, and enters the sea at Youghall, where it dilates into an expansive estuary, forming a harbour capable of containing numerous fleets, were they not excluded by the bar which stretches across its mouth.

The river Lee has, like the Blackwater, its source among the mountains on the confines of Kerry. It flows at first from a romantic lake; proceeds in an easterly direction with a rapid career, till it unites with the ocean, with which it forms the noble expanse of water known by the names of the harbour of Cork and the Cove.

The river Bandon derives its source from the Dunmanway mountains, and, after a south-easterly course of about thirty miles in length, it falls into the Atlantic by Kinsale harbour, which affords excellent anchorage and shelter for all sorts of shipping.

The river Ilen flows from high mountains in the barony of West Carbery, southward to the bay of Baltimore, in which there is good anchorage and some beautiful islands. On the banks of these rivers, and on those of their tributary streams, are many spots of picturesque grandeur and rural amenity elebrated in song. The Awbeg, which unites with the Blackwater, is *the gently flowing Mulla* of Spencer, on the banks of which he composed the principal part of his Fairy Queen.

But besides the great estuaries formed by the confluence of the rivers with the ocean, there are also numerous bays and creeks along the line of the coast, some of which deserve to be noticed; such as Ballycotton bay, which, between the harbours of Youghall and Cork, makes a large circular indentation into the land; Courtmasherry bay, which, after it has run inland several miles in an expansive sheet, separates into two limbs, and runs inland several miles more; Clonakilty bay, farther to the west, ornamented by an island near its head; Crookhaven harbour, which affords shelter to ships driven in by stress of weather, and were it not for the barren ruggedness of its shores, and the remoteness of its situation, might, on account of the extent and excellence of its anchorage, be the resort of navies; Dunman's bay, an arm of the sea which runs between 16 and 20 miles into the interior. But of all the bays on the coast of Cork, that of Bantry is the most magnificent. This great gulph is about 25 miles in length and seven in breadth, and is studded with picturesque islands, of which the high and rocky Bear island, stretching across the mouth of the bay, braves the fury of the Atlantic, and presents on its northern side a spacious and well sheltered haven to the tempest-tost mariner. At the upper end of the bay the fertile and cultivated island of Whiddy rises from the water, and exhibits a finely undulated surface; the shore of the bay is every where rocky, bold, and precipitous. The effect produced on the mind by the survey of such an assemblage of grand objects, is a deep impression of silent and solemn admiration.

All these rivers, bays, and creeks, are well stocked with fish. Salmon, trout, eels, and perch inhabit the rivers; and the salmon of Blackwater are said not only to be abundant, but to be in season throughout the year. The bays, and particularly that of Courtmasherry, are the resort of pilchards, mackerel, salmon, and shoals of herrings and sprats. The sand-eel burrows in the beach near Ross and Castlefreke, vast multitudes of which are dug up by the men with spades, and are gathered by women and boys into baskets.

Climate and soil.—This part of Ireland is remarkable for the mildness of its temperature, never experiencing those extremes of heat and cold to which the same degree of latitude is subject both on the continent and in England. The soft and fanning breezes which blow from the Atlantic occasion this difference; as they temper the highest heats of summer, so as to disarm them of all their scorching influence, and as they mitigate the severest rigours of winter, so that snow, except on the northern side and highest summits of the mountains, seldom lies longer than a few hours even in the dead of winter. The atmosphere, however, is loaded with moisture, the dark clouds of which too frequently intercept the cheering and maturing rays of the sun, and which too often occasion torrents of unseasonable rain.

Mr Townsend divides the soils of the county into four kinds: The calcareous soil, or that which reposes on the limestone districts, the spontaneous herbage of which is of a rich and nutritious quality, and which on culture is well fitted for the production of wheat: The loamy or deep mellow soil, found chiefly in the south-side of the country, and frequently also in the red stone districts; this soil is productive and adapted for the growth of grain: The light shallow soil, resting on a gravelly absorbent bottom, is well fitted for the pasture of sheep, and in wet seasons it yields large crops of corn: And the moorland or peat soil, the usual substratum of which is hard rock or retentive clay; as this species of soil includes the bogs, and many of the mountain summits and declivities, it is more extensively diffused than any of the rest; large tracts of this sort of surface have been reclaimed, and now yield heavy crops of grass, oats, and potatoes.

Agriculture.—The system of middle landlord-ship is here, as in other parts of Ireland, still extremely common,—a system which breaks up the kindly intercourse which should subsist between the proprietor of the land and those by whom it is cultivated, and introduces a set of men whose interest it is to injure both parties, as the whole of their profits are derived from what would either have been paid to the landlord or remained in the pockets of his tenants. Those middlemen have generally leases of three lives and thirty-one years; and subset the land to the peasantry at a rack-rent from year to year, or at most for the term of seven years. The poor peasant generally takes possession of his farm bare of trees, destitute of fences, and without houses fit for the accommodation of human beings, and, with his wife and family, toils and starves to pay the middleman his exorbitant demand. Most of the fields are left in an unsheltered state; and where there are fences, they are generally formed by an embankment of earth, surmounted by furze or coppice-wood, as in the west of England. The plough in use is rude in its form and defective in its execution; the oblique position both of the coulter and sock causes the plough to be inclined to the left side, so as to raise the mould-board out of the ground. When old leas are broken up, a man is required to press the beam of the plough into the ground, and with the almost constant kicking of the ploughman the furrows are very imperfectly turned over. Several farmers have sometimes but one plough among them; and sometimes one furnishes the plough and another the horses. But the Irish have a strong predilection for the spade, for the culture of which the hilly surface of a large extent of this country is peculiarly adapted. Paring and burning of the boggy and moorish soils are methods generally followed in preparing them for the reception of the seed. Stable-dung, lime, sea-weed, and sea-sand, are used as manures, the potato-fields claiming the greater part of the former sort; and indeed the potato-crop is the most important to the common farmer, and employs his own care and requires the labour of his family, as the whole work of preparing the ground, planting the seed, weeding the plants, and raising the crop, is performed with the spade and the hoe. Wheat or barley follows the potato crop, and oats frequently succeed to barley. In the culture of oats the seed is often sown on the

Cork.

stubble and ploughed in, the consequence of which is a thin crop of corn and a plentiful growth of weeds. Wheat and barley harvest commence in August, and that of oats and potatoes is finished before the end of October. Grain of all kinds is stacked on circular stages, which afford an effectual defence against vermin. Cows are never fed but in the field, nor is any provision made for them except hay, a sparing allowance of which they receive in spring and winter. Farm-houses are seldom found in a central situation, but generally on the very margin of the farm, and those of several farms built nearly on the same spot, and separated only by the fences of the respective farms. Houses differ in size according to the circumstances of the occupiers; but when left to the construction of the farmer himself, they are all built on the same plan, and are in general low-walled cabins, without chimnies or glass-windows, with a door on each side opposite to each other, to admit the light; they are divided into two compartments, one of which is the kitchen and sitting-room, and the other the family dormitory and lumber-room. Kitchen gardens are so rarely seen, that a stranger might be inclined to suppose that they were prohibited by law.

Inhabitants.—The natives are a middle sized and muscular limbed race of men, who live on the plainest food, sleep on a damp floor, on straw or rushes, and expose themselves freely to all the variations of the weather, and consequently are capable of bearing the greatest fatigues. Both males and females perform their journies on foot, and think it no great exertion to walk fifty miles a-day, under the pressure of heavy burdens. Early marriages, followed by a numerous offspring, are common; and the chief food of the family is potatoes, with an occasional relish of milk, butter, fish, or flesh. Theft, drunkenness, quarrelsomeness, and superstition, are their most prominent vices. Protestants are numerous, but the great body of the people, particularly the lower orders, is composed of Roman catholics. Lamentation for the dead is here performed by women who have no connection with the deceased, but who attend funerals, and at intervals break out into loud and bitter shrieks of affected sorrow. Lucky and unlucky days, prodigies and omens, have a powerful influence on their rude and untutored minds, and are objects of anxious observation. The population has for several years past been on the increase, which is attributed to early marriages, vaccine inoculation, aversion from emigration, better modes of agriculture, and an improved police. The whole amount, in 1815, was stated at 620,578; and it is cheering to be assured on good authority, that their former idle and dissolute habits are giving way to the peaceful pursuits of laborious industry. They now fare more sumptuously than formerly, and though sometimes bare-legged from choice, seldom from necessity. Porter, as a beverage, seems to be taking the place of whisky; and the more extended cultivation of the soil, and the variety of manufactures recently established, bear testimony, that whatever may be said of their want of skill, they cannot now, with the same justice as formerly, be reproached for their want of labour.

Towns.—This county is divided into 17 baronies, and contains numerous towns and villages. Cork, the capital of the county, and the second city of Ireland, is built on an island in the river Lee, and is encircled by high land on all sides. A branch of the river traverses the town, which communicates with the opposite banks by means of bridges thrown over the north and south branches of the Lee. That on the north branch is a recent structure, designed by Shanahan, a native architect, and does great credit to his professional talents. Over the south branch, which is the smaller, are two bridges, one of which has been lately rebuilt. The old parts of the town are confined and dirty, but many of the new streets are spacious and elegant. The Exchange is a handsome edifice, ornamented with columns of the Doric and Ionic orders; the corn-market is also a well executed building of the Tuscan order; they are, however, much concealed by old houses crowded in narrow streets. The cathedral is well situated, and, as well as the other churches, is kept in good repair. The church of upper Shandon stands on an elevated station, and, in consequence of its high steeple, has a good effect as a distant object. There are, besides these, eight or ten churches on the establishment, and the chapels of the Roman catholics and the dissenters are numerous. A new county-jail has been lately built, and a new town jail is in progress. The town has two theatres, and many houses destined to benevolent purposes, such as schools, hospitals, and asylums. The Cork Institution, now incorporated by charter, has for its object the application of science to the useful purposes of life; has professors of chemistry, botany, agriculture, and natural history; and is funished with a botanical garden, and a good museum. The population of the city is about 86,000 souls. The corporation, under a charter of Charles I. consists of a mayor, two sheriffs, a recorder, several aldermen, and an unlimited number of freemen. Cork is well situated for commerce, and is a convenient emporium for the produce of a fertile district, by having the command of excellent water carriage. Its principal exports are beef, pork, butter, hides, tallow, porter, and whisky; and its principal intercourse is with Liverpool, Bristol, and London. The manufactures of the place are several great porter-breweries and whisky-distilleries, sail-cloth, sheeting, paper, leather, glue, glass, woollen stuffs, and a variety of other articles. Cork is the seat of a bishop, and sends two members to the British parliament; its mayor, while in office, is furnished with a house, and has an yearly salary of L.500 Sterling. The city has well supplied markets, several annual fairs, and is 161 miles south-west from Dublin.

The Cove is situated on the south side of the great island in the harbour of Cork, about six or seven miles below that town. During the late war with France it was strongly fortified, made the depot of military and naval stores, and the station of a port-admiral. The entrance to the harbour, which affords complete security from storms, and abundance of excellent anchorage, is from the south, through a narrow channel, on either side of which the hills rise with a steep and sudden ascent, and are crowned with strong forts.

Cloyne, though the residence of a bishop, and has

Cork. a cathedral said to have been founded by St Colman in the sixth century, seems never to have advanced beyond the rank of a populous village. It stands in a fine valley about 15 miles in a direct line east from Cork, and derives its consequence from the establishment of the cathedral.

Youghall, built on a bay of the same name, has 9000 inhabitants, (among whom are many wealthy families,) governed by a mayor and represented by a member in parliament. It is a place of resort for summer-bathing, has a well established bank, and a handsome assembly-room; it communicates with Cork, from which it is distant about 50 miles, both by water and by means of a mail-coach. It exports grain, potatoes, and bricks. The potato is said first to have been introduced into this place by Sir Walter Raleigh; and the person by whom it was first planted having supposed the apple to be the esculent part, was much disappointed with the result of his experiment, till afterwards, digging up the ground, he found the roots, by which he was amply compensated for his former mistake.

Fermoy, on the river Blackwater, about 14 miles from Cork, on the Dublin road, lately an insignificant village, is now a place rising fast into importance. A large barrack has been built in the vicinity; the old houses have been levelled with the ground, and a new town, in well arranged streets, and with neat uniform houses, is building. Travellers now find good accommodation, and post-horses and carriages. A brewery, a paper, and a bolting mill, are among the new establishments. Many well furnished shops have been lately opened, and a classical school and a new church have been erected. The whole of these, and the other improvements of this place, are chiefly owing to a Mr Anderson, an opulent and enterprising gentleman who purchased the lands in the neighbourhood. The number of inhabitants was, in 1815, about 4000.

Mallow is also built on the Blackwater, about 12 miles west from Fermoy. The mineral waters of this place cause it often to be crowded with genteel company. The neighbouring country is beautiful, studded with gentlemens' seats, and adorned with plantations of trees; but the accommodation in the town is very bad. In summer the inhabitants amount to 5000, a number which is diminished in winter when the company retires.

Blarney, though a small town, possesses extensive manufactures. It stands about four miles to the northwest of Cork, and has a lake in its vicinity about a mile in circumference, well stocked with perch, roach, eels, and leeches.

Kinsale, built on the expansive estuary of the river Bandon, stands on a site of a steep ascent; its streets are narrow and incommodious. It sends a member to parliament, and has a corporation, consisting of a sovereign, a recorder, burgesses and freemen, with about 10,000 inhabitants. The trade of the place is its fisheries and its pilotage. It has also large porter breweries; a barrack filled with soldiery; is a fashionable summer residence, as well as the constant abode of many families of small but competent fortunes.

Innishannon is built about six or seven miles north-west from Kinsale, on the east bank of the river Bandon, and is remarkable for the beauty of its situation. It has extensive linen manufactures and bleaching-grounds; is a post and market-town, with fairs for cattle in May and October. Cork.

Dunmanway is built near the source of the Bandon, in a small flat surrounded with mountains, and is well situated for becoming the seat of manufactures.

Bandon, about ten miles from Kinsale, on the river of the same name, is a large town, containing upwards of 14,000 inhabitants. Its corporation, under a charter obtained from James I. consists of a provost, 13 burgesses, and 12 common councilmen. It has two market-houses, two churches, with several chapels. It has a market on Wednesday and Saturday, and three fairs in the course of the year. The linen manufacture, the wool-combing, the camblet, and stuff-trade, blue dyeing of the country manufactured cloth, tanning, porter-brewing, cotton-spinning, &c. are branches of business carried on to a great extent in this town, and afford full scope to the industry of the inhabitants. A new bridge across the river has been planned, and great improvements have been effected both in the suburbs and the interior of the town.

Ross-Carbery, an ancient but poor town, inhabited chiefly by weavers, stands on the edge of a sandy beach, said to have been once a harbour. The cathedral, adorned with a spire, and embosomed in trees, is its most conspicuous object. It has a market on Wednesday, and three annual fairs.

Clonakilty, situated on a bay of the same name, about 20 miles south-west from Cork, has a church, a Roman catholic chapel, a barrack, a court-house, many handsome dwelling-houses, and shops well stored both with the necessaries and the luxuries of life. It has also large quays and extensive granaries; it manufactures coarse linens, and exports grain and potatoes to Dublin and Cork, and imports grocery goods, bricks, tiles, and earthen-ware. Its weekly market is on Friday, and its annual fairs are in March, September, and November. The corporation is composed of a sovereign, a recorder, 24 burgesses and freemen. The inhabitants are between four and five thousand.

Skibbereen, on the Ilen, has about 4000 inhabitants and many good houses. It has porter and beer breweries, and bolting-mills; is the emporium of the landward produce, for the disposal of which it has a market on Saturday, and four annual fairs. The prevalence of the western winds renders its communication with the sea precarious and uncertain; but it has an extensive overland trade with Cork, from which it is distant about 40 miles, in a south-west direction.

Baltimore is situated on the eastern shore of the bay to which it gives its name, and looks westward over a coast studded with islands, the most considerable of which are those of Ennishekin and of cape Clear. In 1631 it was entered by a party of Algerine pirates, who not only plundered the town but carried off many of the inhabitants, a disaster from the effects of which it has not yet recovered. Besides these, Castle Martyr, Middleton, Rathcormuck, Castle-Lyons, Mill-street, Macromp, and Bantry, are also considerable towns, some of which are rising fast into importance.

Ecclesiastical state.—In the county were once three dioceses, Cloyne, Cork, and Ross; but the two latter have been long united, so that there are now only two. Cloyne derives its revenue from land and tithes; that of the united dioceses of Cork and Ross, almost entirely from land. The patronage of both is considerable. Benefices are composed sometimes of single parishes, and more frequently by the permanent or temporary union of several. Many of the parishes have no churches, and more of them have no glebe-houses, which, in numerous instances, deprives the peasantry of the advantage arising from a resident clergy, to the want of which much of the prevalent ignorance and rusticity, as well as vice of the county, must be attributed. Roman catholic places of worship are, it is said, on the increase, and dissenters from the church are numerous, especially in the towns.

Antiquities and curiosities.—In different parts of the county are found heaps of stones, mounds of earth, caves, and pillars, generally supposed to have been of Druidical origin. Some curious remains of this kind occur in the vicinity of Clonakilty, particularly the ruins of a church, within a circular enclosure. The ruins of Christian churches and monasteries are no less frequently met with than the rude monuments of Paganism. The mouldering abbey of Ross-Carbery was once celebrated as the seat of piety and learning. The village of Buttevant exhibits an assemblage of religious edifices, sufficient in any period to raise admiration. These and the other religious houses of this part of Ireland were built by English adventurers after the invasion of Henry II. The castles and keeps of the ancient feudal lords are likewise numerous; and of which the castles of Blarney, Macromp, Lohort, and others, are entire, and still inhabited. At Skeaf, in the barony of Duhallow, is a burying-place, in which still-born children only are interred. In the limestone districts are many caverns, of sufficient size to excite the attention of the curious; at Leap, on the east side of Glandore harbour, is a bog impregnated with copper ore, the ashes of which bring L.10 or L.12 a ton; and at Hungry-hill, on the shore of Bantry bay, is a stupendous water-fall. Far above the level of the sea a lake is collected, which empties itself over a precipice in a sheet 30 feet in width; and having reached the rocks below it, forms a chain of rapid and beautiful cascades. The agitation which all this occasions, dashes a considerable part of the water into mist, from which in sunny weather a brilliant rainbow is reflected.

CORMORANT, or CORVORANT, a species of sea fowl belonging to the genus Pelicanus. See *Pelicanus*, under Ornithology.

CORN, in a more restricted sense, is applied to grain in the ear, or unthrashed grain; but, in a more extensive acceptation of the term, signifies all kinds of grain which is employed for the purpose of food, as wheat, barley, oats, rye, and maize, or Indian corn, and including also leguminous productions, as peas and beans.

CORNCRAIK. See *Rallus* under Ornithology.

CORNEA, one of the coats of the eye, so named from its resemblance to horn.

CORNEILLE, Peter, an eminent French dramatic writer, was born at Rouen in 1606, and educated by the Jesuits, for whose care in the cultivation of his mind he cherished, during the whole of his life, a grateful recollection. He studied law with the view of making it his profession, was called to the bar, and was employed for a while as advocate-general in one of the courts of his native city. But before he had time to distinguish himself as a lawyer, he was incidentally engaged in more congenial studies, to which he afterwards devoted the whole strength of his talents, and by which he enriched the literature of his country, and procured for himself an honourable niche in the temple of fame. He happened to captivate the affections of a young lady to whom he had been introduced by her lover—a circumstance which made so deep an impression on his mind, that he made it the foundation of a dramatic piece, which he finished before he was nineteen years of age, and which was represented with good success under the title of Melite. As his mind had been soothed by the composition of this drama, and as the peals of applause by which it was received by the public had yielded him a still higher degree of delight, he endeavoured to perpetuate his pleasure by a similar employment of his time, and by repeated appeals to the admiration of his countrymen. Clitandre was the next production of his dramatic genius, which in 1637 was followed by Le Cid, the plot of which he borrowed from the Spanish writer Guillelmo de Castro.

The public received Le Cid with unbounded applause, and criticism assigned it the highest place among the finished specimens of dramatic excellence that had hitherto appeared in the French language; but, as is usual in similar cases, powerful efforts were made by the malignity of envy to depreciate its merits. Even Richelieu degraded himself by his hostility towards a poem which he had been frequently heard to admire, and the author of which he had been induced to reward. At last, on the suggestion of Scudery, the French academy, with the consent of all parties concerned, was chosen umpire of the controversy—an office in the exercise of which this learned body had the address to satisfy both Richelieu, the public, and Corneille.

Long after he had surmounted all those attempts to tarnish his laurels, and had stood preeminent in public estimation, as the first dramatist of that or of any former age, the palm of popularity began to be disputed with him by Racine, the tender pathos of whose love stories, as well as the charms of novelty, sustained by genius, succeeded in securing for him a large portion of that admiration which Corneille had for so long a period continued entirely to engross. The rest of his dramatic pieces, after this new claimant for honours and applause had appeared, were but coldly received, and he began to be talked of as *the old Corneille*, intimating that he had become unfashionable, and hinting that it became him to rest satisfied with the reputation which he had acquired. In these suggestions he seemed to acquiesce; for he withdrew his attention from the stage, engaged in religious studies, and translated into verse the treatise of Thomas a Kempis *de imitatione Christi*, which is said to have been so popular that it passed through thirty-two different editions. But after this period he returned to dramatic composition; produced Œdipe, Attila, and others, and continued to write for the stage till his 70th year. Thus attaining the verge of human existence, he abandoned entirely all secular employments; spent the evening of his days in the exercise of the duties of piety, to which indeed he is said to have been attentive at every period of his life; and he died in the year 1684, and in the seventy-ninth of his own age.

In personal appearance he is said to have been of a tall stature, of an expressive countenance, to which the vivacity of his eye essentially contributed. In his manners he was simple, and in his dress remarkably plain. In his private character he seems always to have been attentive to the decencies and proprieties of life. He was well skilled in classical literature, as well as in *belles lettres* and criticism, and was a great admirer of the heroic virtues of the Romans, of whom he was a close and a constant imitator, both in his own conduct and in the delineation of dramatic characters. The productions of his muse are numerous, and of various degrees of merit. Of all his dramatic pieces, Le Cid was the most popular, to which for a long time in France any thing peculiarly excellent was compared in this proverbial phrase—*Il est beau comme la Cid.*

He published, in the course of his dramatic career, upwards of thirty different pieces for the stage.

CORNELIAN or CARNELIAN, a mineral substance, which is employed for ornamental purposes. See Geology.

CORNU AMMONIS, Snake or Serpent's Stone, a kind of petrified shell-fish of various species and sizes, which are found imbedded in marl, limestone, and sandstone.

CORNUCOPIA, or horn of plenty, from which, according to ancient mythology, proceeded abundance of all things. The fable is supposed to have derived its origin from a small territory in Lybia, in form somewhat resembling the horn of an ox, and remarkable for its fertility, which King Ammon assigned to his daughter Amalthea, who, according to the fiction of the poets, was the nurse of Jupiter. The cornucopia, or horn of plenty, is represented, in architecture and sculpture, under the figure of a large horn, furnished with fruits, flowers, and ears of corn.

CORNUCOPIÆ, a genus of plants belonging to the Triandria class, and including plants which belong to the tribe of grasses.

CORNUS, Cornel-tree, Cornelian Cherry, or Dogwood, a genus of plants belonging to the Tetrandria class.

CORNUTIA, a genus of plants belonging to the Didynamia class.

CORNWALL, the most southern county, and most western peninsula of England, lies between the latitude of 49° 57′ and 50° 53′ north, and between the longitude of 40° 12′ and 50° 41′ west, and is bounded by Devonshire on the east and north, by the mouth of the Bristol channel on the north-west, and by the English channel on the west and south. Its superficial extent is about 1185 square miles, or 758,484 English acres.

General aspect.—In form this county is said to resemble a *cornucopia*, being very narrow at its western extremity, and widening towards the east. Its coast is very irregular, high and rocky, indented into bays, and forming several remarkable capes and head lands; as the *Land's-end*, its most westerly; the *Lizard*, its most southern; and the *Ram-head*, its easternmost point. The general face of the country is barren and desolate, exhibiting many hills with intermediate valleys, extensive wastes of many thousand acres, and a great scarcity of wood and water.

Hills and rivers.—The hills of Cornwall form the western extremity of that mountainous range which traverses England from Cumberland, though here they are comparatively low, one of the highest points, Brown-willy, being not more than 1368 feet above the level of the sea. The county is watered by six rivers, the *Tamar*, which rises in the parish of Morvinstow, and, after pursuing a direction nearly south for forty miles, falls into the harbour of Hamoaze near Plymouth; the *Camel*, rising by two sources at Camelford and Roughter, which pour their united streams into the Bristol channel at Padstow; the *Looe*, remarkable for forming a large reservoir of fresh water near the sea, into which it afterwards flows by a subterraneous canal; the *Fal*, which joins the English channel at Falmouth; the *Lynher*, and the *Fowey*.

Soil and climate.—The soil of this county generally consists of a slaty or gravelly substratum, covered with a moderate layer of black earth, or loamy clay. In some of the valleys it is naturally fertile. The air is extremely damp, and north-westerly winds prevail for the greatest part of the year. From the contiguity of the sea, too, the salt-water spray prevents the growth of trees and shrubs for a considerable distance in the neighbourhood of the coasts. Still the climate of Cornwall is as mild as in any part of Britain, and many exotic plants thrive and blossom in the open air.

Natural history.—No county in Britain is richer in mineral productions. Of metallic ores there are above a hundred mines, viz. 45 of copper; 28 of tin, 18 of copper mixed with tin, 2 of lead, 1 of silver, 1 of silver mixed with lead, 1 of silver and copper, 1 of copper and cobalt, 1 of tin and cobalt, and 1 of antimony. There are also found, in small quantities, manganese, wolfram, and arsenic, of which the last is mixed with copper in the state of metallic salt. Among the principal stony minerals may be enumerated granite, grauwacken, of which there is an extensive tract, quartz, serpentine, micaceous schistus, and hornblende slate. There are found here two valuable materials for making porcelain, soap-rock, and kaolin, of the latter of which much is exported to Cheshire and other places. Some rare minerals also occur, as tourmaline, green fluor spar, sonorous slate, swimming-stone, and especially those crystallized siliceous gems called *Cornish diamonds.*

Of all the mineral treasures of this county, *tin* is the most valuable. Of this metal three different ores are found: the common *tinstone*, which is very general; the *wood-tin ore*; and *tin pyrites*, which last is very rare, and said to be found only in Cornwall. The tin is usually found in veins, called *lodes*, or in horizontal layers. Sometimes it is in detached masses called *shodes*, at others in a course of such masses forming a *string*, or *stream*. The working of the tin mines is carried on according to a regular system. Each mine or piece of ground where ore is sought for belongs to one or more proprietors, or adventurers, and the ore as it is brought up is divided into shares, according to the number of these; the several shares are then beaten small in a stamping-mill, and washed in pits, over which runs a stream of water, to carry off the earthy particles. What remains is melted and cast into blocks of 200 or 300 weight, and these are four times a year carried to the nearest of five towns appointed for that purpose, to be stamped. Each block of 320 pounds is estimated at L.10 sterling, and the whole county is supposed to produce annually about 25,000 or 30,000 blocks.

Cornwall had formerly a distinct breed both of sheep and cattle, but few of either are now to be met with. The sheep were small, and had such coarse fleeces that their wool was called *Cornish hair*. The cattle were small boned, with a great proportion of bone and offal, were of a black colour, with short horns, but very hardy. Of the birds, one of the most remarkable is a species of crow, called the *Cornish chough*, which is said to be inordinately addicted to *thieving*. Among the numerous fish taken on the coast the most profitable is the pilchard, which, like the herring in the North sea, constitutes a very lucrative branch of the British fisheries. It is computed that, from the middle of July to the end of September, the usual season for pilchards, not less than 50,000 casks, containing each 3000 fish, are taken on the Cornish coast.

Although the loftier vegetable productions thrive but indifferently in this county, it is by no means deficient in plants, and even some rare species are occasionally met with, as *asparagus officinalis*, *eryngium campestre*, tamarisk, *erica vagans*, and a species of ligusticum, called from this its principal habitat *Cornubiense*, *Sibthorpia Europœa*, &c.

Population.—According to the return made to Parliament, the whole population of the county amounted in 1801 to 188,269, and in 1811 to 216,667, so that in ten years the population had increased 28,398. The number of inhabited houses in 1801 was 32,906; in 1811, it amounted to 37,971,

Divisions.—Cornwall is divided into nine hundreds, viz. East-hundred, Kirriar, Lesnewth, Penwith, Powder, Pyder, Stratton, Trigg, and West-hundred; and these hundreds comprehend 198 parishes, and contain 27 market towns. The principal are Launceston, Bodmin, Falmouth, Truro, Penzance, Padstow, St Ives, Lestwithiel, Camelford, Penryn, Fowey, Saltash, Helston, Stratton, Bossiney, St Mawes, and St Michael. Of these Bodmin has already been noticed in the order of the alphabet, and the two last are here enumerated as forming two of the Cornish boroughs.

Launceston is situated upon a down, on the west bank of the river Tamar. Though accounted the chief town of the county, the assizes being held alternately here and at Bodmin, it is a small place, containing not more than 1500 inhabitants. It is one of the principal *stannary* towns, or those to which the tin is taken to be stamped, and has a small manufactory of woollen cloths. In the old language of the county this town was denominated Dunhivid. It was erected into a borough by Henry III. and has a market every Saturday. Distance from London 214 miles. Cornwall.

Falmouth, which, in point of importance, is the chief seaport in Cornwall, consists of one principal street, about a mile in length, built along the beach, at the foot of an eminence that overlooks the harbour. It is of modern date, and was made a royal borough by Charles II. Markets are held here three times a-week, on Tuesday, Thursday, and Saturday; population about 4000, of whom nearly two-thirds are females. Falmouth is remarkable chiefly for its harbour, which is one of the best in Britain, and is capable of receiving ships of any burden. Its entrance is defended by two castles; Pendennis, standing on a rock 300 feet above the water, built by Henry VIII. and repaired by Oliver Cromwell, flanking the western side; and St Mawes, nearly of the same date, occupying the eastern side, and forming, with the houses in its neighbourhood, an independent, or rather a separate borough. This town is one of the chief stations for the pilchard fishery; and packets sail regularly during peace for Spain, Portugal, America, and the West Indies. Distance from London 268 miles. N. Lat. 50°, 8'; W. Long. 5°, 2'.

Truro, one of the stannary towns and principal boroughs of the county, stands at the head of Falmouth harbour. In its immediate neighbourhood lie some of the richest tin and copper mines, and great quantities of these metals are shipped from hence every year. A market is held twice a-week. The Gothic church is venerable for its antiquity. Distance from London 257 miles. N. Lat. 50°; 16'. W. Long. about 5°, 10'.

Penzance, is situated on a creek opening from Mount's-bay, not far from the Land's-end. It is a populous and thriving town, and employs much shipping in the tin trade and pilchard fishery. Penzance was added to the stannary towns by Charles II. A market is held every Thursday. Distant from London 281 miles.

Padstow, stands on the left bank of the river Camel, near its entrance into the Bristol channel, about 30 miles west of Launceston, and 243 from London. It carries on some trade with Ireland, and has a market on Saturday.

St Ives is remarkable only for being one of the chief ports for the pilchard fishery. It stands on the bay of the same name on the Bristol channel, has a market twice a-week, on Wednesday and Saturday, and is 276 miles from London. Its harbour is considered very insecure for shipping. N. Lat. 50°, 18'; W. Long. 5°, 30'.

Lestwithiel, a stannary and market town and borough, stands near the mouth of the small river Fowey, 19 miles from Plymouth, and 233 from London; has a weekly market on Friday, and formerly

Cornwall.

small craft could come up the Fowey to this town, but of late the channel has filled up. Near this place there are two fine seats, Boconnoch, the property of Lord Camelford, and Restormel-castle. N. Lat. 50°, 27′; W. Long. 4° 41′.

Penryn, stands on a creek of Falmouth haven, about two miles above that town, on an eminence which commands a fine view of the sea and surrounding country. It has a considerable trade both in the pilchard fishery at home, and in the cod-fishing on the banks of Newfoundland. Markets are held here three times a-week, on Wednesday, Friday, and Saturday. Distance from London, 266 miles. N. Lat. 50°, 10′; W. Long. about 5°.

Saltash, is a market town, with some trade, especially in malt, and consists of three streets, built on the descent of a steep hill near the river Tamar, about six miles from Plymouth, and 220 from London. Market on Saturday.

Stratton is situated near the north-eastern corner of the county, between two rivulets, which here unite and flow into the Bristol channel. It has a market on Tuesday, is 18 miles from Launceston, and 221 from London.

Bossiney, is situated on the coast of the Bristol channel, near King Arthur's castle, 17 miles from Launceston, and 232 from London. It is not properly a market-town, though it sends two members to Parliament, and has two fairs yearly, on the 3d August and 22d November.

Camelford, is a small market-town, with broad, well-paved streets, built along the river Camel, and containing, with the surrounding parish, 1100 inhabitants. It is an ancient place, and was constituted a borough by Edward VI. It was the scene of a bloody battle between the Britons and Saxons in 823. The market is held on Friday, and there is a fair four times a-year. Distance from London 228 miles.

Fowey is situated on a river of the same name, where it flows into the English channel, having a safe and commodious harbour, defended by three batteries, and capable of receiving large vessels. It is populous and flourishing, and the inhabitants are engaged in the pilchard fishery, and even carry on some foreign trade. It is a borough town, and has a market on Saturday. Distance from London 240 miles. N. Lat. 50°, 19′; W. Long. 4°, 38′.

Helston, a stannary, borough, and market-town, built in form of a cross, is situated on the river Looe, close upon the English channel. It is large and populous, and carries on a thriving trade, chiefly in tin and fish; the weekly market is held on Monday. It is 274 miles from London. N. Lat. 50°, 7′; W. Long. 5°, 17′.

Agriculture.—In farming the inhabitants of Cornwall are by no means equal to their neighbours, owing, in a great measure, to the obdurate nature of their soil. The usual grains of wheat, barley, and oats are cultivated, and of the last that species called by botanists *avena nuda*, and by the Cornish farmers *pilez*, is generally preferred, as its straw affords good fodder for cattle. Excellent potatoes in great quantities are produced, and upon the extensive waste lands are fed numerous flocks of sheep and goats. The manures employed are chiefly fish, formed into a compost with earth, &c. or sea-weed, or sea-sand, which last is used in great quantities, and is applied with good effect both to the moorlands and the loamy soils. Oxen are much used for draught.

Coromandel.

Manufactures, trade, and commerce.—But few manufactures are carried on in Cornwall. They consist chiefly of paper, coarse woollen cloths, carpets, crucibles, and spikes and nails for ship-building. But the trade of the county is very considerable, though confined chiefly to the coast or to Ireland. The principal exports are tin, copper, moorstone, kaolin for making porcelain, fish, cattle, pigs, and potatoes; and the chief imports are groceries, wood, and coals. If we except the mining operations, the greatest object of trade in Cornwall is the pilchard fishery, which is supposed to employ not fewer than 12,000 persons, and to produce a revenue of at least L.50,000 per annum.

Antiquities.—Several remarkable antiquities occur in Cornwall, most of them supposed to be Druidical, consisting principally of cairns, cromlechs, and circles of stones. There are also several natural curiosities, of which the most deserving of notice are those called *logan-stones*, composed of large upright, or inclined masses of granite, with a single stone of the same nature, of great size and weight, so poised upon the others as to be easily moved with the hand, though the united strength of many men could not hurl it from its situation.

Cornwall forms a duchy, vested in the person of the king's eldest son, who holds a ducal-court, and it belongs to the diocese of Exeter, and forms part of the western circuit. It returns 44 members to the house of Commons, contributes 640 men to the militia, and pays eight parts of the land-tax. The Cornish dialect, which once formed a distinct language, no longer exists.

No part of Britain seems to have been more early known to the ancients than Cornwall, and it is generally believed that the Phœnicians resorted hither for tin and copper. It was brought under subjection to the crown of England by Athelstan in 938, and was attached to the king's eldest son by Edward III. in the person of the Black Prince.

COROMANDEL, the eastern coast of the peninsula, on this side the Ganges in Asia, is bounded on the north by Golconda, on the east by the bay of Bengal, on the south by Madura, and on the west by Bisnagar. The extreme heat which is felt from May to October, is lessened at night by the sea-breezes, and rain and hurricanes continue from November to December. The coast is generally an open roadstead without harbours, and difficulty is experienced in landing owing to the surf. Vast quantities of calico are exported from Coromandel, for which are imported cloths, iron, lead, copper, coral, &c. from Europe, and pepper, rice, sugar, corn, and dates, from different regions of Asia.

When hot winds prevail, the coast of Coromandel is parched up, every blade of grass is withered, and, excepting the trees, no verdure is to be seen. But when the rains fall, vegetation is restored, the plants revive, and a rich green is spread over the country. It appears from observation, that the longer the hot land wind continues to blow, the succeeding months prove healthier to the inhabitants.

CORONA is a luminous circle surrounding the sun, the moon, the planets or fixed stars, and otherwise denominated *halo*. Some of these luminous circles are white, and some exhibit the colours of the rainbow. Sometimes a single corona only is seen, and sometimes several of them arranged in concentric circles appear at the same time. These appearances, it is obvious, depend on the refraction of the light passing from the luminous body to the eye of the spectator, and this refraction is produced by a particular state of the atmosphere. A corona may be produced by placing a lighted candle in the midst of steam during cold weather; or if a glass window be breathed upon, and the flame of a candle be placed at the distance of some feet from it, while the spectator is at the distance of some feet from another part of the window, the flame will be surrounded with a coloured halo; and if a candle be placed behind an exhausted glass-receiver, when air is admitted and reaches a certain degree of density, the vapour with which it is loaded produces a coloured halo round the flame.

CORONER, an ancient officer in England, so called because he has principally to do with pleas of the crown, or such as more immediately concern the King; and hence the Lord Chief-Justice of the King's bench is the principal coroner in the kingdom, and may exercise the jurisdiction of that officer in any part of the realm. But coroners are appointed in every county; they are chosen by the freeholders, and their authority is equal to that of the sheriff. The office is for life, and removal can only take place by a declaration of incapacity, or by holding other offices which are incompatible with its duties. The duties of a coroner are chiefly judicial. It is his business to enquire when a person is slain, or dies suddenly, or in prison, concerning the manner of his death. This enquiry must proceed on view of the body, and at the place where the death happened, in presence of a jury of four, five, or six of the inhabitants of the neighbouring towns within his jurisdiction. This proceeding is called the *coroner's inquest*. If any person be found guilty of murder by this inquest, the coroner commits him to prison for farther trial; and it is his duty to enquire also concerning the lands, goods, and chattels which are thus forfeited; and the whole of this inquisition must be certified to the Court of King's bench, or to the next assizes. Another branch of the office of coroner is to enquire concerning shipwrecks, and to certify whether or not a wreck has taken place, and who are in possession of the goods. It is also his duty to inquire concerning *treasure trove*, or found treasure, who are the finders, in whose possession it is, or where it is concealed. The coroner acts also in a ministerial capacity, as substitute of the sheriff, when any just exception is taken to that officer, or suspicion of partiality. See *Blackstone's Commentaries*.

CORONILLA, Jointed-podded COLUTEA, a genus of plants belonging to the Diadelphia class.

CORPORATION, a body politic or incorporate is so called, because the persons or members are united into one body, and possess certain privileges, and means are provided for maintaining a perpetual succession. Corporations, of which various kinds exist, have been established for the advancement of religion, learning, trade, or commerce; and they are either *sole*, when the corporate rights are vested in a single individual and his successors, in some particular office or station, or *aggregate* when they consist of many persons united together into one society, and are kept up by a perpetual succession of members. Corporations are again divided into ecclesiastical, or such as are composed of members who are spiritual persons, and are constituted for the purpose of promoting religion, and of perpetuating the rights of the church; and lay-corporations, which are either civil, eleemosynary, or for charitable purposes. Those of a civil nature are erected for temporal purposes, for the good of government, for the advancement of literature and science, and for the regulation of manufactures and commerce. Charitable corporations are constituted for the perpetual distribution of the free alms or bounty of the founder. Of this description are hospitals for the support of the poor, and for the cure of the sick.

By the civil law, corporations seem to have been created by a voluntary association of their members. But in England the king's consent implied or expressed is absolutely necessary for their establishment. The privileges of a corporation are to have perpetual succession—to sue or be sued—to purchase and hold lands—to have a common seal—and to make bye-laws or private regulations. Corporations are dissolved by act of parliament, by the natural death of all its members, by surrender of its franchises, and by the forfeiture of its charter through negligence or abuse of its privileges.

CORRECTION-HOUSE, a place of confinement for persons guilty of crimes of an inferior degree, who suffer punishment by being obliged to labour, and to submit to certain privations during a fixed period, according to the nature of the offence. Of the advantages of such institutions for the reformation of offenders, various opinions have been held, according to the view which has been taken of the effects and consequences that are supposed to follow the restraint to which the criminal is subjected. It has been considered as one of the great defects of the laws of this country, that excepting the punishment of death, no other is accompanied with that degree of severity and terror, to awe or restrain offenders from the commission of crimes. On this subject, the following remarks by Dr Paley are highly worthy of notice. "The laws of England are not provided with any other punishment than that of death, sufficiently terrible to keep offenders in awe. Transportation, which is the punishment second in the order of severity, answers the purpose of example very imperfectly; not only because exile is in reality a slight punishment to those who have neither property nor friends, nor regular means of subsistence at home, but because the punishment, whatever it be, is unobserved and unknown. A transported convict may suffer under his sentence, but his sufferings are removed from the view of his countrymen; his misery is unseen; his condition strikes no terror into the minds of those for whose warning and admonition it was intended. This chasm in the scale of punishment produces also two farther imperfections in the administration of penal justice; of which the first is, that the same punishment is extended to crimes of very different characters and malignancy; and the second, that punishments separated by a great interval, are assigned to crimes hardly distinguishable in their guilt and mischief." This defect, it has been supposed, might be obviated by the proper management of correction-houses; for as the object of punishment is not only the amendment of the offender, but is intended to operate as an example to others, both objects seem attainable by the confinement and labour to which criminals are subjected in such places, with better hopes of success, than by any kind of punishment provided by the laws of this country.

CORREGIO, a celebrated painter, who is most generally known by this name, derived from his native place, a small town in the duchy of Modena, and who flourished in the early part of the 16th century. The family name was Allegri. See ALLEGRI.

CORREZE, a department of France to the northwest of Cantal, corresponding nearly with Lower Limosin, is about 22 French leagues in length and 20 in breadth, and contains upwards of 260,000 inhabitants. The soil in general is not remarkably fertile, but the country altogether has a beautiful and highly picturesque appearance, from the number of pastures, farms, and woods scattered on its surface. It yields little grain, but has good wine and fruit. Mines of iron, lead, and copper, are sources of wealth to the inhabitants. The name of Correze is taken from a river which joins the Vezere below Brive. The Dordogne also partly waters this territory.

Tulle, the capital, situate near the conflux of the Correze and Solane, in Long. 1°, 42′. E. and Lat. 45°, 16′. N. is a pretty large town, containing upwards of 9000 inhabitants, has a cathedral, famous for its steeple, and carries on a considerable trade in woollen goods and other manufactures.

Brive, on the Correze, 12 miles south-west of Tulle, has nearly 6000 inhabitants, and is also a manufacturing town. The fruitful plain in which it stands is bounded by hills, pleasantly clothed with vines and woods.

Ussel, 32 miles north-east of Tulle, has about 3000 inhabitants, and is the capital of the dukedom of Ventadour.

Uzerche, a neat little town on the Vezere, 10 miles north-north-west of Tulle, has upwards of 1000 inhabitants, and a rich Benedictine abbey.

Turenne, a castellated town, near the southern border of the department, gives name to a viscounty, and is the chief of a district which is studded with small towns and villages.

CORRIGIOLA, BASE-KNOT GRASS, a genus of plants belonging to the Pentandria class.

CORROSIVE SUBLIMATE, the old name for the muriate of mercury, or, according to the present views of the constitution of that substance, the chloride of mercury, derived from its destructive effects on the organs of digestion, when taken internally.— See CHEMISTRY.

CORSICA, an island in the Mediterranean sea, lies between 41° and 43° north latitude, and 8° 40′ and 9° 43′ east longitude; is of an oblong or oval shape, extending from north to south, on an average, 100 miles, and from east to west about 45, and is supposed to contain upwards of 4000 square miles of surface. It lies to the north of the island of Sardinia, from which it is separated by the straits of Bonifacio, reckoned eight miles broad; and its northern extremity is 18 leagues west of the coast of Tuscany, and more than 30 south of the Genoese territory.

The general appearance of the island is mountainous and woody; it is sparingly studded with plains or valleys, and these are neither extensive nor highly cultivated. The chief elevations are Monte Rotondo, Monte D'Oro, and Monte Cinto, all situate near the centre of the lofty ridge which traverses the island from north to south, and divides it into two unequal parts. The first of these mountains, which is also the highest, rises about 10,000 feet above the level of the sea; and the tops of all of them are commonly capped with snow throughout the year. The basis of the mountains is understood to be granite, and rocks of the second and third orders, or the transition and secondary classes, according to modern geologists, are described as resting upon it, and, with a solitary exception on the eastern side, as decreasing in height towards the sea. This island, accordingly, has been confidently referred to as an example and happy illustration of the Wernerian arrangement. But be this as it may, it affords no inconsiderable interest to the mineralogist. Beds of argillaceous schistus, frequently intersected with veins of white quartz, are found near the shore. Calcareous rocks of various kinds support the soil in many districts. Fine marble is met with in some places. Jaspers, porphyries, serpentines, asbestos, granite of various hues, and many other minerals, including some precious stones, are not unusual; and several traces of silver, copper, lead, and iron ores, have been discovered.

Of the numerous streams with which Corsica is watered, the Guolo or Golo, and the Tavignano, are the chief. The first has it origin in lake Ino, near the centre of the island, and, after a course of about 70 miles, joins the sea near the site of an ancient city called Mariana or Nicæa, on the north-east coast. The Tavignano rises in another lake called Crena, not far from the former, and running eastward through a barren country, enters the sea near the ruins of Aleria on the east coast. Besides the two lakes now named, there is a third, which is tolerably large, in the vicinity of Aleria, called the Stagno di Diana; and a fourth, called Biggulia, on the north-east coast, has a communication with the sea, and may therefore be denominated a gulph or inlet. The principal harbours are Bastia and Porto Vecchio, on the east coast; Bonifacio on the south; Ajaccio on the west; and San Fiorenzo on the north.

The climate of Corsica is considerably various; but, on the whole, less moderate or agreeable than might be expected from its geographic position. In winter the cold is often intense, and the heats of summer would be almost intolerable, were they not modified by the sea-breezes. The east coast, besides, Corsica. is noted for the prevalence of marshy effluvia, which render a residence there very hazardous to health. It is highly probable that an improvement would be effected in this respect as a consequence of greater and more judicious labour bestowed on the cultivation of the soil, which, though generally speaking, far from being rich, is in some districts fertile in fruits and grains, especially wheat, oranges, lemons, figs, and chesnuts. The timber, which grows in vast quantities on the sides of the mountains, and which is chiefly of the oak and pine species, furnishes one of the greatest articles of export from the island. A good deal of silk is raised, and is in high demand by the French and Genoese for a variety of manufactures. The fisheries afford subsistence and employment for a large proportion of the natives.

The number of inhabitants in the island may be reckoned at about 180,000, all of the Roman catholic religion, to which they are zealously attached. Their characteristic features are ignorance and indolence, qualities which, so long as they continue, and there is now no prospect of their removal, preclude the hope and the possibility of improvement. Mr Boswell computed the population, in his time, at 220,000, a number so much greater than what it was estimated at in 1740, viz. 120,389, that one is tempted to think either that one or other statement was inaccurate, or that the events of the last quarter of a century have drained the island of a very large quantity of its inhabitants. One circumstance alone may be allowed to yield some probability to this latter opinion. The brilliant career of Bonaparte, who is a native of Corsica, could hardly fail to operate as an inducement to abandon a spot where, for several years, there had scarcely been presented a single opportunity for the exercise of genius or ambition.

Before the French revolution, this island was divided into two parts, each of which consisted of several provinces. The departmental division, which arose out of that catastrophe, was also into two parts: viz. Golo and Liamone, each subdivided into three circles; Bastia, Calvi, and Corte, in the former; Vico, Ajaccio, and Sartenne in the latter. But an enumeration of the most interesting particulars respecting the country will be best given in the order of the provinces, beginning with the northern quarter, or

Di qua da Monti, which comprehends seven provinces.

1. *Câpo Corso.*—This contains several market towns and a good number of villages. It has some spots very fertile in vines and olives, but in general is mountainous and rocky. On various parts of it are to be discovered the remains of forts or towers, which were erected in former times as a defence against pirates, who infested the island.

2. *Bastia.*—The most fruitful part of Corsica has a town of the same name, which is the capital of the island. It is indifferently built, but contains a palace, a cathedral, and an academy, and has a good harbour, which is pretty well defended. The population of this town is about 6000. It lies about 80 miles S. S. W. of Leghorn.

3. The most important object in *Nebio* is the bay of San Fiorenzo, which affords safe anchorage for shipping. The town of the same name is a small place, situate in an unhealthy country. Corsica.

4. *Balagna* is productive in wine and oil; is altogether a pleasant district, and has one or two ports favourable for trade.

Calvi, in the north-west part of the island, is a bleak and barren territory, possessing a good harbour, but having only a few places on the coast that are well inhabited.

6. The inland province of *Corte* is large, populous, and agreeably diversified with hills and vallies. The town of the same name, near the centre of the island, is pleasantly situate in a plain surrounded by mountains, and boasts of its university. Some highly picturesque scenes adorn its neighbourhood.

7. *Aleria*, an unhealthy district on the east coast, has a great number of villages, which are but poorly peopled; and its chief town of the same name is a ruinous place, near the mouth of the Tavignano. A ridge of mountains extending from this point across the island, forms the common boundary of its two larger divisions.

Di la da Monti contains five provinces.

1. *Bonifacio* and *Porto Vecchio*, on the south coast, is tolerably fertile in fruits and grain, at least in those plains which intersperse the more elevated regions. The harbour of Bonifacio is large and safe, and the small town of Porto Vecchio is situate at the bottom of a well sheltered gulph.

2. *Rocca* has nothing worthy of remark but the gulph of Campo Moro, or Valinco, which affords good anchorage for ships.

3. *Istria* is still less worthy of notice.

4. The province of *Ajaccio*, on the west coast, has a well built town of the same name, defended by a citadel, and containing 4000 inhabitants. It lies about 15 leagues N. N. W. of Bonifacio.

5. *Vico* has a market town of the same name in the interior, which is a bishop's see.

This island was known to the Greeks by the name of Cyrnus. It was visited and possessed by the Carthaginians, from whom it passed to the dominion of Rome. In the latter days of the empire, it fell, together with Sicily, into the hands of Totila, the gallant and enterprising king of the Goths, for a time. It was subdued by the Saracens in the eighth century. Then the kings of France having taken possession of it, made it over in a gift to the papal see, by which again, in the time of the Crusades, it was ceded to the republic of Pisa; but on their victory over that power, the Genoese became its masters, and retained the dominion for some centuries. The oppressive behaviour of these sovereigns at last excited a rebellion among the natives, who determined to throw off the yoke and become an independent state. For this purpose they chose for their king one Neuboff, a native of Germany, who had promised them great succours, and had, in reality, brought them some supplies of money and arms. But these soon failed, and in the meantime the Genoese having obtained assistance from France, recovered their dominion. This occurred in 1736. The hapless monarch, obliged to flee the island, took refuge in England, where new misfortunes awaited him; for, being imprisoned for debt, he was only relieved by the act of insolvency, after consigning over the island to his creditors, and in the course of a few years terminated his life in extreme poverty. This was the more disgraceful to the nation on whose generosity he had thrown himself, as the government actually espoused his cause, and aided him with a fleet in a new attack on the island in 1741. The Corsicans made various other struggles for liberty, but with no better result. That under the celebrated General Paoli, on whom they conferred the chief command in 1763, was the most remarkable, and for a time the most promising. This singular man was at last compelled to give way to superior force, and, like his predecessor, seek an asylum in Britain. This was in 1768. The Genoese, tired of the contest in which they were so expensively and so tediously engaged, had made over the sovereignty of the island to France. Paoli was favoured many years subsequently with an opportunity of shewing his attachment to his native country, by procuring for it the honour of a component part of the state under the republican government. He afterwards revolted, and having called in the aid of England, succeeded, after some opposition, in expelling the French. Thus Corsica, in 1794, was declared united to Great Britain. But this union was of no longer continuance than 1796, when the British found it necessary to evacuate the island, the inhabitants of which, wishing to share in the flattering prospects and rising fortune of their extraordinary countryman, Bonaparte, renewed their allegiance to the nation whose military renown and power he was so rapidly extending. Since this period it has remained subject to France, but in all probability scarcely either defrays or compensates the expense of its own government.

CORTONA, an ancient town of Italy, occupies a fine situation on the side of a mountain, and is about 30 miles south-east from Sienna; has several public edifices, as churches, a museum, an academy, a public library, and several convents; some of the churches are adorned with valuable paintings; the walls of the town, of which some remains are still in good preservation, were constructed of large blocks of stone without cement; and the academy was instituted for the investigation and elucidation of the antiquities of the country.

CORTUSA, Bear's-ear Sanicle, a genus of plants belonging to the Pentandria class.

CORUNNA, a sea-port town of Gallicia, in Spain, stands on a peninsula, at the entrance of a fine bay of the Atlantic ocean, and is divided into the upper and lower, or old and new town. The old town, distinguished by the name of Pescaria, occupies a tongue of land, which is nearly surrounded by the sea, and the new town, on the side of a declivity, is enclosed by walls, and defended by a citadel. Among the public buildings of Corunna are enumerated several churches and chapels, four convents, two hospitals, an artillery and naval school, an arsenal, an armoury, store-houses, a powder magazine, and an aquæduct. An ancient tower claims notice, both from its great height and the solidity of its construction. The harbour of Corunna, the entrance of which is defended by two forts, is spacious and commodious, and enjoys the advantage of a light-house erected on a lofty mountain about a league distant.

The population of Corunna is estimated at 4000. The principal manufactures are hats, lace, combs, with calicoes and table-linen; rope-making is also one of the branches of the industry of the inhabitants; and Corunna has been long known for its commercial intercourse.

CORVUS, the Raven and Crow, a genus of birds belonging to the order of Picæ. See Ornithology.

CORYBANTES, were priests of Cybele, who danced to the sound of flutes and drums. They are represented as madmen by Catullus, in his poem entitled *Atys*, which contains a beautiful description of them. The name is derived from Corybas, the son of Jason and Cybele, who, passing into Phrygia with his uncle Dardanus, instituted the worship of the mother of the gods. But, according to another opinion, the Corybantes were the children of Jupiter and Calliope, while it is stated by others that they educated Jupiter, during his concealment in Crete from his father Saturn, who threatened his destruction, and hence Corybantica was a festival held in that island to their memory.

CORYDALIS, a genus of plants belonging to the Diadelphia class.

CORYLUS, the Hazel, a genus of plants belonging to the Monœcia class.

CORYMBIUM, a genus of plants belonging to the Pentandria class.

CORYMBUS, a term in Botany, signifying a peculiar mode of inflorescence. See Botany.

CORYNOCARPUS, a genus of plants belonging to the Pentandria class.

CORYPHA, Mountain-palm, or Umbrella-tree, a genus of plants belonging to the order of palms. See Botany.

CORYPHÆNA, a genus of fishes belonging to the order of Thoracici.

CORYPHÆUS, the principal leader of those who composed the chorus in the ancient tragedy; and the same name has been applied to the chief of a sect, and assembly, or council.

COSENZA, the chief town of Hither Calabria, in the kingdom of Naples, stands upon seven hills at the southern extremity of a spacious plain, and it is said that it is nearly three miles in extent. The castle occupies an eminence near the confluence of the rivers Busiento and Crathis. The cathedral is a massy structure; and a church near the castle is adorned with paintings, which have the character of the school of Raphael.

By a late estimate of the population it is stated at 16,000. Knives, and some other kinds of hardware, with some earthenware, are the chief manufactures; and the surrounding territory, on which are planted numerous villages, is well cultivated, and produces corn, fruits, wine, oil, and silk. Public tribunals are held in Cosenza; and an annual fair brings together great numbers of people from the neighbouring provinces. Alaric, the celebrated Gothic chief, it is said, was interred in the bed of the river Busiento, which was turned from its course by the labour of prisoners, and after his body was consigned to the earth, with all his treasures, the river was restored to its former course; and, still more certainly to obviate discovery of the place, all the prisoners who were employed were put to death.

COSMOGONY, from two Greek words, signifying *the world*, and *to produce*, is an account of the formation or creation of the world, a subject which has given rise to much learned discussion, both in ancient and modern times. See GEOLOGY.

COSSACKS, the name of a people who inhabit the banks of the rivers Dnieper and Don, near the Black sea, on the borders of Turkey. The word, alluding to their military habits, signifies irregular troops of horse, and they have been distinguished by that name since the middle of the 10th century, when they occupied the regions on mount Caucasus, and were reduced under the Russian dominion about the beginning of the 11th century. The Cossacks have been divided, according to the countries which they inhabit, into European and Asiatic. But they are also distinguished by the names of the river on whose banks they have established themselves, as the Don Cossacks, whose chief towns are Tcher, Chasco, and Kasankaia, the former of which contains 15,000 inhabitants; besides which are the Cossacks of the Black sea, of the Volga, of Orenbourg, of the Ural, of Siberia, and some other places.

The Cossack population under the dominion of Russia is stated at half a million, of which 200,000 are liable to be called upon by government for military service. The Cossacks generally profess the Greek form of religion; they are not indifferent to the advantages of education, for in a public academy, in their principal town on the banks of the Don, languages and other useful branches are taught, and some of their officers are well instructed and highly accomplished. Their hospitality and politeness are commended by travellers who have visited their country. See Tooke's *View of the Russian Empire*, Pallas's *Travels*, and particularly Clarke's *Travels*.

COTE D'OR, a department of France which occupies the north-east corner of the ancient province of Burgundy. It is reckoned 65 miles long and from 25 to 50 broad, contains upwards of 440 square leagues of surface, and has a population rated above 350,000. The country is pleasantly diversified with hills and plains, and is well watered by the Seine, which has its origin in the district of Chatillon belonging to this department, the Saone and its tributaries, the Ouche and the Tille, and several smaller streams. Grain is cultivated in some districts, and fruits are generally abundant; but the chief produce is wine, which has long been esteemed of excellent quality, and is in such demand as to constitute the principal article of trade. Among the subjects of the mineral kingdom found here, are mentioned iron, marble, porphyry, and a hard stone which furnishes good millstones. This department is divided into four circles, viz. Dijon, Beaune, Semur, and Chatillon-sur-Seine.

Dijon, the capital of the department, as it was of the province of Burgundy, is pleasantly situated at the foot of a hill in a fertile plain, watered by the Ouche and Suzon, two streams which run south-east to join the Saone. It is well built, has some fine public edifices, especially churches, and is defended by a castle and walls. The streets are broad and well paved, hospitals and religious houses are numerous; and the city boasts of its university and an academy of sciences. The inhabitants exceed 20,000, many of whom are engaged in the wine trade, and still more in the manufacture of muslin and other goods. In the vicinity of the town is a monastery remarkable for the magnificent burial places of the Burgundian princes. Dijon lies 60 leagues south-east of Paris, and 35 north of Lyons. It is the birth-place of several noted men, as Bossuet, Crebillon, Piron, Rameau, Quentin, Diderot. It was here that the celebrated Guyton Morveau successfully performed his first experiment on the means of purifying infected air. In the winter of 1773, in consequence of the air being contaminated by putrid effluvia arising from dead bodies lodged in the vaults, it was found necessary to shut up one of the churches of this city. After various attempts to purify it by the vapour of vinegar, the detonation of nitre, and the burning of perfumes, &c. application for advice was made to this chemist, who recommended fumigation with the vapours of muriatic acid, as disengaged by the action of sulphuric acid on common salt. The process was so effectual that not the slightest odour of an offensive nature could be discovered the next day after the fumigation; and the experiment was beneficially repeated in the same year in the prisons of the city, where an infectious fever, of a malignant kind, had made its appearance.

Beaune, a little but neatly built town, containing about 9000 inhabitants, is also pleasantly situate at the foot of a hill, 25 miles S.S.W. of Dijon. It is remarkable for the excellence of its wine.

Semur, or *Semur-en-Auxois*, situated on the Armançon about 34 miles north-west of Dijon, is a walled town, containing upwards of 4000 inhabitants, who are chiefly occupied in the manufacture of cloth. Its castle is built on a rock of granite, washed by the river.

Chatillon-sur-Seine, so denominated to distinguish it from other places having the same name, lies in the north extremity of the department, about 40 miles north-west of Dijon. It was once a large town, but now scarcely contains 4000 inhabitants. It is divided into two parts by the river Seine, from which it receives its discriminating appellation. Here it was in the spring of 1814 that an unprofitable negociation was some time carried on by the ministers of the allied powers and Bonaparte.

Besides these four towns, the heads of the circles into which this department is divided, may be mentioned the following places, as for some reason or other worthy of notice.

Flavigny, once considerable, but reduced in the civil wars, lies about 30 miles north-west of Dijon. It is built on an eminence covered with vineyards, and possesses a Benedictine abbey, which was founded in the 7th century.

Montbard, to the north-west of Flavigny, is a little walled town, noted as the birth place of Buffon.

Saulieu, anciently a residence of the Druids, is a trading town containing about 3000 inhabitants, situate in a fruitful territory five leagues south of Semur.

Nuys or *Nuits*, a town four leagues S.S.W. of Dijon, contains two churches, two convents, and two hospitals, and is noted for good wine.

Citeaux, about the same distance south of Dijon, is remarkable for the chief abbey of the Cistercian order, which was founded by one of the Dukes of Burgundy near the end of the 11th century.

St Jean de Laone or *Losne*, a fortified place 15 miles S.S.E. of Dijon, stood a vigorous siege in 1636, for which Lewis XII. freed it perpetually from paying poll-tax.

Seure, south-west of the preceding, contains about 3000 inhabitants, and is seated in a fertile country.

COTES, Roger, a mathematician of considerable eminence, was a native of Leicestershire, and was born in 1682 at Burbage, where his father was rector. At the early age of eleven, while at school in Leicester, he discovered a strong bias for geometrical studies; and having spent some time at St Paul's school in London, he was admitted in 1699 a pensioner of Trinity college, Cambridge, and six years afterwards was elected fellow of the same college. In the succeeding year, which was the 24th of his age, he was appointed Plumian professor of astronomy and experimental philosophy. An edition of Newton's *Principia*, for which Mr Cotes drew up a preface which has been much admired, added to the reputation which he had already attained. But the only work which appeared during his life, was a description of a meteor which appeared in 1715, and which was printed in the Philosophical Transactions. His posthumous works are connected with geometrical and physical investigations; and the celebrated *Cotesian* theorem, which is well known to every learned mathematician, was also found among his papers after his death. He died in 1716, in the vigour of life, and when he had only reached the 33d year of his age.

COTES DU NORD, a department of France, so named from its position on the northern coast, occupies part of the ancient province of Bretagne, or Brittany. It is 65 miles long, of a breadth varying from 27 to more than 40 miles, extends about 2800 square miles, and contains upwards of 500,000 inhabitants. A considerable ridge of hills traverses it nearly in the direction of its length; but, notwithstanding, it is scantily supplied with rivers of any consequence. It abounds in heaths and pasturage, and such of its districts as are cultivated yield tolerable quantities of grain. But its chief produce, besides excellent cattle, are fruit, especially apples, hemp and flax. It possesses also several mines of lead and iron, which are wrought to some profit; and carries on manufactures of linen and woollen goods, leather, and iron-ware. The climate is reckoned variable and rainy. This department is divided into five circles, denominated from their chief towns, viz. St Brieuc, or Brieux, Denan, or Dinant, Loudeac, Guingamp, and Lannion, of which in order.

St Brieux, the capital, is a well built little town, which carries on some trade, situate about half a league from the sea coast, in an agreeable and fertile valley, environed with hills. It is a bishop's see, possesses a small harbour, which lies about 11 leagues to the west of St Malo, and contains upwards of 8000 inhabitants.

Denan, about 20 miles south of St Malo, is also a trading town, built on a hill, in a district washed by the Rance, has a castle the walls of which are noted for their thickness, and contains about 4500 inhabitants, a large proportion of whom is engaged in the manufacture of cloths, flannels, &c.

Loudeac is a small place, 20 miles south of St Brieux, which carries on an iron work, and a manufacture of thread.

Guingamp, situate 6 leagues to the west of St Brieux, is almost a single street, built on a small stream called the Rieux, and inhabited by more than 5000 people. There is an abbey in its vicinity.

Lannion, to the north of Guingamp, is a small town which carries on a trade in wine, and manufactures of hemp, &c.

Besides these places may be mentioned the following, as deserving some notice in the account of this department.

Fregnier, a good sea-port, 25 leagues north-west of Brest, which carries on some trade, and contains 3000 inhabitants. Northwards of it lie *les sept Isles*, seven small rocks surrounded with shoals, often visited, and partly inhabited by fishermen.

Lamballe, four leagues south-east of St Brieux, has a good trade in cattle, linen cloth, and parchment.

Quintin, pleasantly situate in a valley, above 10 miles S. S. W. of St Brieux, has a castle, and gives name to a duke.

COTTON, a well known soft downy substance which is produced within the pod of the cotton plant, and in which the seeds are embedded. For an account of its mode of culture see Botany; and for the spinning of cotton see Spinning.

COTTUS, or Bullhead, a genus of fishes belonging to the order of Thoracici. See Ichthyology.

COTYLEDON, Navelwort, a genus of plants belonging to the Decandria class.

COVENANT, a term in English law, denoting the consent and agreement of two or more persons to perform some contract; or it is the declaration made by contracting parties, that they adhere to such agreement relating to lands or other property, and is created by deeds in writing, or implied in the contract. A writ or action of covenant is the remedy to recover damages for breach of contract.

COVENANT, in the history of Scotland, denotes a contract or convention solemnly entered into in 1638 by the people of that country, for maintaining the national religion. A confession of faith or national covenant was drawn up by the General Assembly in 1581, was subscribed by the King, and the observation of it was enjoined to all his subjects; it was again subscribed in 1590, and in 1596, and the subscription was renewed in 1638, when the subscribers engaged by an oath to maintain their form of religion as it was in 1580, and to reject all innovations introduced since that time. The oath or declaration annexed to the confession of faith, was denominated the covenant, and those who subscribed it received the appellation of covenanters. For the purpose of forming a bond of union between Scotland and England by the bond of religion, the solemn league and covenant was concluded in the year 1643. It was approved by the Parliament and assembly at Westminster, and ratified by the General Assembly of Scotland in 1645, and rejected by Charles I. when he surrendered himself to the Scottish army in 1646. But Charles II. declared his approbation both of this and the national covenant, by a solemn oath, which was renewed at his coronation at Scone in Scotland.

COVENTRY, a city of Warwickshire in England, has a claim to considerable antiquity, and has been long celebrated for its manufactures. The name is supposed to be derived from the ancient British words signifying convent town, in allusion to a nunnery which was destroyed by the Danes in the beginning of the 11th century. Some of the older streets are narrow and confined; but some of its public buildings are magnificent edifices, as St Mary-hall, an ancient structure, remarkable for its windows, on which are figured whole length portraits of some of the kings of England, and of some eminent citizens of the place; Draper's-hall, which is a handsome modern structure; and particularly St Michael's church, whose steeple, rising to the height of more than 300 feet, and which commenced building after the middle of the 14th century, is regarded as one of the finest pieces of architecture in the kingdom. Coventry is united with Lichfield under one see.

The population of Coventry, which is said to have amounted to 15,000 in the reign of Henry VIII. approached nearly to 10,000 in 1811. But the population of the city and county is stated at 23,787. The manufacture of cloth was in a flourishing state about the middle of the 14th century, and continued till the 18th, when it was transferred to Yorkshire. Shags, camblets, and some other woollen stuffs, with the manufacture of silk ribbons, chiefly, at the present time, occupy the industry of the inhabitants. By means of inland navigation, Coventry enjoys every facility to its trade and manufactures, and communicates with the principal towns of England.

COULAM or COVELONG, from *covel* a temple, a small town on the sea coast of the Carnatic, 25 miles south from Madras, and near the ruins of a fortress which formerly belonged to the East India Company of Ostend. The vicinity of this place is chiefly remarkable for seven temples of Indian architecture, which are cut out of the hard rock of which the mountain is composed, and the sides of the temples are sculptured with the figures of various animals which are held sacred in the Hindoo worship.

COULOMB, Charles Augustus, an eminent French philosopher, was born at Angouleme in 1736, and having removed in early life to Paris, discovered a strong bias to mathematical pursuits. He entered the corps of military engineers, and after nine years residence in Martinique, he first appeared as an author on the subject of carrying on hydraulic operations under water. His attention was next directed to the construction of the magnetic needle, and to the theory of simple machines, where he also treats of friction and the stiffness of ropes; and connected with the subject of the magnetic needle, one of his most curious investigations refers to theoretical and experimental researches on the force of torsion, and on the elasticity of metallic wires. For the measurement of this force he invented an ingenious machine. The labours of Coulomb were afterwards devoted to the subjects of electricity and magnetism in general, and he was fortunate in making essential improvements on the common magnetic needle and on the dipping needle. He demonstrated that the magnetic attraction is inversely as the square of the distance, and shewed that it is diminished as the temperature is increased, and that it is not confined to iron alone.

At a late period of his life, Coulomb was appointed to the superintendance of the public works in Bretagne; but at the commencement of the revolution, the distracted state of the country rendered it necessary for him to resign his offices, and soon after he was compelled to leave Paris, when he retired with his friend Borda to the vicinity of Blois; in this place he collected materials for a paper on the circulation of the sap in trees, which appeared among the memoirs of the National Institute; and in 1798 he presented to the same society an elaborate and curious paper, containing the result of experiments for determining the quantity of action which men can furnish by their daily labour, according to the different methods by which it is exerted. The subject of magnetism was again resumed; and the cohesion of fluids, a treatise on which appeared in the memoirs of the Institute, occupied a considerable share of his attention. Coulomb was engaged in preparing a new system of weights and measures, and was afterwards appointed one of the inspectors-general of studies. He died in 1806, when he had reached the seventieth year of his age, and left behind him a character which was admired on account of his splendid talents by the public, and respected and beloved on account of his amiable virtues in private.

COUNTY originally signified the territory of a count or earl, but it is now analogous to *shire*. For the more convenient government of the country and the administration of justice, England and Wales are divided into 52 counties, of which Lancaster, Chester, and Durham, are denominated counties palatine, and have peculiar privileges. Scotland is divided into 45 counties.

COURLAND, formerly a duchy of the kingdom of Poland, and now a government of the Russian empire, is bounded by the Baltic sea and the gulph of Riga on the west, north, and partly on the east, and every where else by the governments of Livonia, Witepsk, and Wilno, and extends over a surface of 11,200 square miles, chiefly between the 56° and the 57° of north latitude, and the 21° and 27° of east longitude.

Physical state.—This part of the continent of Europe is diversified by gently swelling hills, in which iron, copper, amber, chalk, and building materials are found; and is watered by the Dwina, which rises in an elevated region in Russia, and, as it flows towards the gulf of Riga, divides this government from that of Livonia; the Windau, which descends from the heights of Samogitia, and thence crosses the country toward the Baltic sea; the Aa, which flows in an easterly direction, till it joins the gulph of Riga; and the Bartan and Mupa, which, with many other streams, feed the larger rivers. The climate, though salubrious, is subject to be darkened by frequent fogs, and to be varied by sudden changes

The country in general is open, and productive of corn, hemp, and flax; but in some parts it is clothed with forests of pine and fir, interspersed with occasional groves of fine oak, and sprinkled with much underwood. The pastures maintain numerous flocks and herds; the breed of horses is of a superior quality; the deer and the elk traverse the forest, the fox and the wolf have their haunts among the rocks; in the fields and the woods, along the coast and in the rivers, is no lack of either the feathered or the finny tribes commonly found in the northern parts of Europe.

Social state.—While under the administration of its duke, this region was divided into Courland Proper, Semigallia, and the bishopric of Pilten; but since it became subject to Russia, it has been distributed into these five circles:—Goldingen, Libau, Windau, Swikum, and Jacobstadt. Mittau, the capital city, is built on the banks of the Aa, in the midst of a very fertile and agreeable country; it is a long rambling town, composed of brick houses stuccoed white, intermingled with wooden buildings. The ducal palace exhibits a style of magnificence disproportioned to the petty influence any of its possessors had ever the power to exert; and the academy, instituted in 1785, contains nearly as many professors as students. Goldingen on the Wela, is defended by a castle, and is 60 miles from Mittau. Libau, a seaport on the Baltic, is 45 miles north of Memel. Windau, at the mouth of the river of the same name, has a good harbour, and is fortified by a castle. These, with their respective circles, and a number of inferior towns and villages, are said to contain about half a million of inhabitants. Their mode of cultivating the soil is extremely rude; and so unacquainted are they with draining, that the meadows lie under water the greater part of the winter; manufactures, too, are still in their infancy; but they export from Libau and Windau considerable quantities of grain, hemp, flax, timber, turpentine, wax, potash, hides, amber, and metals, for which they import sugar, tea, coffee, wine, and cloth. The roads throughout the country are extremely indifferent; but the villages are neat, the scattered cottages and gentlemen's seats prettily situated amid clumps of trees, and inns are built at reasonable distances from each other, and comfortably furnished.

Previous to its incorporation with Russia in 1795, Courland was a fief of the crown of Poland, to which its duke did homage for the privileges he enjoyed. But the power of the nobles was inconsistent with every principle of sound policy. They were free from arrest, unless within 24 hours after the commission of the crime; they engrossed all the important offices of the state; they were exempted from all taxes and imposts whatsoever; and their power over the peasantry was absolute and unbounded. The internal history of the country is little else than a series of disputes between the duke and the nobles; and its boasted freedom was nothing more than the spirit of faction under the name of liberty, which being interpreted, means aristocratical licentiousness, oppressing others, but free itself to commit all manner of enormity.

Moral state.—The character of nations takes its form and complexion from the political system under which they exist; and when practices and habits are once introduced and formed, they become inveterate through custom. Though therefore the arrangements of the new government should be dictated by the wisest policy and the kindest humanity, it will be long before the higher orders forget or forego their accustomed privileges and before the lower orders emerge from their degradation; and till then the peasants will be oppressed, manufactures and merchants will be despised, ignorance will prevail, learning and industry be neglected, and savage and unsocial vices be propagated. The Lutheran religion is professed by the great body of the people, but those who hold other tenets and observe other forms are tolerated.

COURT denotes the palace or place where the king or sovereign prince resides, within the verge or limits of which certain privileges are enjoyed, as in the case of insolvent debtors, who have the benefit of freedom from arrest. In a legal sense, the same term is applied to a place where causes are heard and determined, or where justice is judicially administered. The sole executive power of the laws being vested in the person of the king, according to the British constitution, all judicial establishments through which he administers the laws are derived from the power of the crown. The extent of jurisdiction and forms of proceedings, or the courts of judicial establishments, are very various.

In England, the *picpoudre* court is the lowest and most expeditious in its mode of proceeding, and is so called either from the dusty feet of the suitors, or because causes are decided as speedily as dust can fall from their feet. The *court-baron* is held by the steward in every manor, and takes cognizance of matters relative to tenures, and has also jurisdiction in personal actions of debt, trespass, and the like, under forty shillings. The *hundred court* which is in all respects similarly constituted, is considered as a larger court-baron. The county court falls within the jurisdiction of the sheriff, and the freeholders are the regular judges, while the sheriff is the ministerial officer.

The courts of a more general nature, whose jurisdiction extends over the whole kingdom, are the court of *Common Pleas*, the *court of King's Bench*, the *court of Exchequer*, the *high court of Chancery*, the *courts of Assize*, *Nisi Prius*, and the *House of Peers*, which latter is the supreme court of judicature in the united empire.

The ecclesiastical courts of England are, the *archdeacons court;* the *consistory court;* the *court of arches*, which is a court of appeal in each province; the *court of peculiars*, a branch of the court of arches, having jurisdiction over those parishes that lie in the midst of other dioceses; the *prerogative court;* the *court of delegates*, which is the great court of appeal in ecclesiastical causes; and the *court* or *commission of review*, which is nominated in extraordinary cases to revise the sentence of the court of delegates. The *court of admiralty* has jurisdiction of all matters or injuries arising upon the seas or in places beyond the reach of common law; and, besides these, various other courts have been established of a more limited and special jurisdiction.

The courts of England having a criminal jurisdiction, are the *high court of Parliament*, the *court of the lord high-steward*, the *court of King's Bench*, the *high court of Admiralty*, the *court of oyer and terminer* and *general gaol delivery*, the *court of general quarter-sessions*, and some other courts of more limited jurisdiction.

In Scotland, the different courts of law are, the *baron court*, which is limited to feu-duties, rents, and services of vassals and tenants; *borough-courts; justice of peace courts; consistorial*, or *commissary court; court of the high admiral*, relative to maritime causes; the *court of exchequer;* the *court of Justiciary*, which is the supreme criminal court; and the *court of Session*, which is the supreme civil court.

The jurisdiction of the court-martial extends to matters connected with military discipline; it consists of thirteen commissioned officers, of whom the president is required to be a field-officer. The sentence of a court-martial, against which no appeal lies, is reported to the king, who has the power of approving or modifying the decision. Blackstone's *Commentaries*, and Erskine's *Institutes*.

COURTRAY, a town of the Netherlands, stands on the banks of the river Lys, which traverses the town, and contains more than 13,000 inhabitants, who are employed in brewing, soap-making, starch-manufactories, sugar-refining, and the manufacture of earthen-ware, beside linen-cloth, cotton-stuffs, and lace. The flax raised in the vicinity of Courtray has been long celebrated for its excellent quality.

COUTANCES, a town of the department of La Manche, is famous for its magnificent cathedral, which is reckoned one of the finest Gothic structures in the kingdom. The population exceeds 8000; and the manufactures are, coarse woollen stuffs, tanning of leather, and making of parchment.

COWES, a town on the north-east coast of the isle of Wight in England, is eight miles south-east from Portsmouth, and stands on the declivity of a hill on the west side of the river Medina. The lower parts of the town have narrow, irregular, and crowded streets; but the pure air, and fine prospects of the more elevated parts, attract numerous strangers, for their summer residence, and the advantage of cold and warm-bathing. The trade in provisions is considerable. East Cowes stands on the opposite side of the river; is of less limited extent, but, beside being the seat of the customhouse, is the residence of several merchants; and the vicinity of the town is adorned with many elegant and beautiful seats.

COWLEY, Abraham, the most eminent of that class of poets who, from their affectation in tracing far-fetched and forced analogies between material and mental objects, have been distinguished by the appellation of the metaphysical school of poetry, was in the year 1618 born in London, the posthumous son of a grocer, whose widow had the misfortune to be left in indigent circumstances. Cowley is one of those poets who may be justly said to have "lisped in numbers," for, as he relates in his essay on himself, he was from his childhood so captivated with the charms of verse and poetical descriptions, by reading Spencer's Fairy Queen, which he found in his mother's apartment, that his mind at that plastic period received a tendency to poetry which it ever after retained. His mother, by an exertion of her own interest, or by the excitement of pity in the breasts of persons in power, procured her son's admission into Westminster school, where he was soon distinguished, though it is said he never could prevail on himself to bestow the labour requisite for committing to memory the ordinary rules of grammar.

In the 13th year of his age, while at school, he published a collection of poems, entitled *Poetical Blossoms*, which contained the *Tragical History of Pyramus and Thisbe*, written when he was only ten years old, and *Constantia and Philetus*, written two years after. In 1636 he was removed to Trinity college, Cambridge, where two years after he published *Love's Riddle*, a comedy which he composed at Westminster school, and *Naufragium Joculare*, or *The Merry Shipwreck*, a comedy in Latin, after it had been acted by the members of the college. At Cambridge, too, while still a young student, he composed the greater part of his *Davideis*, "a work of which Johnson says the materials could not be collected without the study of many years, but by a mind of the greatest vigour and activity." As the prince passed through Cambridge on his way to York, at the commencement of the civil war, he was entertained by the representation of a dramatic piece written, or rather roughly drawn, by Cowley, and repeated by the scholars under the name of the *Guardian*.

In 1643, having previously obtained the degree of master of arts, he was, through the prevalence of parliament, ejected from Cambridge, sought shelter at Oxford, and published a satire against the predominant party, entitled the *Puritan and the Papist*, and so distinguished himself by the warmth of his loyalty, and the elegance of his conversation, that he gained the confidence and the kindness of Lord Falkland, as well as of the rest of the king's friends, whose notice cast a lustre on all to whom it was extended. After Oxford surrendered to the Parliament he followed the queen to Paris, where he became the secretary of Lord Jermin, afterwards Earl of St Alban's. He was absent from England about ten or twelve years, bearing a share of the distresses, and labouring in the affairs of the royal family, on whose account he performed many dangerous journies to Jersey, Scotland, Flanders, Holland, and other places, and was the principal instrument in maintaining a correspondence between the king and queen, cyphering and decyphering their letters with his own hand.

In the year 1656 he returned to England, with the design, as it has been said, of observing the state of public affairs, and of imparting information to his exiled friends, but was soon after seized through mistake by officers sent in quest of some other royalist; being however in custody he could not obtain his liberty till Dr Scarborow had become bound for him in the sum of L.1000. After his liberation he published an edition of his poems, among which he inserted his *Mistress*, in which it is said he praises

Cowley. beauty which he never saw, complains of jealousy which he never felt, and talks of smiles and frowns, of hope and despair, which never had any existence, except in his own imagination. About this time he was made a doctor of physic at Oxford, and appears in the list of the original members of the Royal Society, under the title of Dr Cowley. At the restoration he wrote a *Song of Triumph*, and was entitled, from his important services and tried fidelity, as well as from the conscious possession of great abilities, to expect at least the fulfilment of the promises which he had received both from the first and second Charles. This was the mastership of Savoy, which he had the mortification to see bestowed on another; and this chagrin was deepened by the manner in which his comedy of the Guardian, now published under the title of *The Cutter of Coleman Street*, was treated by the public, by which it was spurned from the stage, and then censured as a satire on the king's party. While under the depression of spirits arising from these and other causes, he published his *Complaint*, in which he stiles himself the *melancholy* Cowley, which, like other complaints, excited more contempt than pity, and which drew on him some satirical stanzas, inserted in a poem published about that time on the choice of a laureat, in which he is called the *Savoy-missing Cowley*.

About this time the vehement desire of retirement, with which he had formerly been actuated, seems to have returned upon him with more urgent solicitations, for it prompted him not only to speak in praise of solitude, but actually drove him into the country, first to Barn-elms, and afterwards to Chertsey, in Surrey, where he obtained an advantageous lease of the Queen's lands, which brought him an ample income. But he did not long enjoy the pleasure or suffer the pain of seclusion; for he died in the town of Chertsey, in the 49th year of his age, of a severe cold, which assumed the symptoms of consumption. He was buried with great pomp, near Chaucer and Spencer; and King Charles pronounced, that he had not left a better man in England. Dr Sprat also, who knew him well, and has written his life, calls him the most amiable of mankind.

Cowley, had he kept to the natural expression of poetical ideas, possessed genius and learning to have raised him to the first rank of poets, and kept him there; but all his publications are sadly contaminated with the absurdity and extravagance of the metaphysical school of poets to which, unfortunately, he belonged. This class of writers commenced with Donne, who imitated Marina and other Italians, and who in his turn was imitated, or at least his conceited and allegorical manner adopted by Drayton, Crashaw, Cowley, and many others. This manner consists, as has been well shewn by Dr Johnson in his critique on Cowley's poetry, in drawing conceits from the recesses of learning; in far fetched thoughts; in enormous hyperboles, and violent fictions; and in horrible representations. But with all these faults with which the poetry of Cowley is far from being free, his works abound with numerous instances of fine thoughts naturally expressed, of gaiety, and ease, and elegance. His ode on Wit is said, by Johnson, to be without a rival,—his Chronicle to be a composition unrivalled and alone,—and that, in his prose essays, nothing is far-sought or hard laboured, but that all is easy without feebleness, and familiar without grossness.

Cowper. COWPER, William, a distinguished poet, descended by his father, the Reverend Dr John Cowper, from Earls, High-chancellors, and Chief-justices, and by his mother, Anne, daughter of Rodger Dame, Esq. from Henry III. of England, through several noble families, was born in 1733, at Great Berkhampstead in Hertfordshire, of which his father was rector. His mother, who is said to have been still more amiable than she was high born, died while he was yet a child of six years; but her maternal tenderness, which had made an indelible impression on his feeling heart, he afterwards commemorated in a poem of exquisite beauty and pathos. The elementary part of his education was commenced in a day school of his native village, and was prosecuted at the academy of Dr Pitman of New-Market, a few miles from his father's residence; and two years subsequently, in consequence of the appearance of specks on his eyes, in the house of a female oculist in London. In his tenth year, he was placed at Westminster school, where he continued to reside till the year 1749. Under the rough discipline of that celebrated seminary, apparently so ill suited to the excessive sensibility of his nature, he imbibed abundance of classical literature, and by means of the small pox, which has deprived thousands of their sight, his eyes were completely cleared of the specks that had threatened him with blindness.

After a short visit to the scenes of his childhood, he was engaged by articles for three years to Mr Chapman, a solicitor in London, with a view to his instruction in the practice of the law, and forthwith became an inmate of that gentleman's family. But his mind was little disposed to legal pursuits, so that he spent the greater part of his time in the house of a near relation. "There was I," he says in a letter to Lady Hesketh, "and the future Lord Chancellor (Lord Thurlow,) constantly employed in giggling, or in making giggle, instead of studying the law." On the expiry of the term of his engagement with Mr Chapman, he took possession of chambers in the Inner Temple, but still without any predilection for legal pursuits, instead of which he cultivated poetry and polite literature, and associated with the elder Coleman, Bonnel Thornton, and Lloyd, with other literary characters whom he had first known at Westminster. Twelve years of his life glided away in this manner, in which he contributed several elegant essays to the Connoisseur, and translations from Horace, and original poems to some other periodical publications, but in which his patrimonial portion was nearly exhausted, the hopes of his friends as to his deriving a livelihood from the practice of the law completely frustrated, and his own wish to form a matrimonial connection painfully precluded. To obviate some of these difficulties, the offices of reading clerk, and clerk of the private committee of the house of Lords were procured for him, but unfortunately nature had disqualified him for fulfilling their duties. The idea of a public exhibition, which he regarded as "mortal poison," haunted his imagination, and raised in his mind a tide of conflicting emotions bordering on distraction. His friends, therefore, with the view of restoring his tranquillity, got the appointment exchanged for the less lucrative, but more private, office of clerk of the journals in the House of Lords. This arrangement calmed the perturbation of his mind, which, however, by an unforeseen event, was again thrown into tenfold commotion. A dispute in the House of Lords relative to the appointment to which he had just been nominated, rendered it necessary for the new clerk of the journals to undergo an examination at the bar of the House,--a trial from which he shrunk with such strong horror, that it unhinged his understanding to a degree that caused his friends to think no more of the clerkship, but of his recovery; and, with that view, they placed him at St. Alban's under the skilful and kind treatment of Dr Cotton, who, in the space of eight months succeeded in healing his wounded spirit, and with whom, for the sake of his society, he lived a year after he had been pronounced in a state of convalescence.

It has been confidently asserted, and currently believed, that the first aberrations of Cowper's mental faculties proceeded from the views of religion which he had adopted; but it is now known that religion as an exciting cause had no share in the malady, although when it had assumed the form of *hypochondriasis*, the subject of religion, contemplated through the medium of a distorted imagination, wore a terrific aspect, which tended to deepen his distress. When, however, he began to recover, the mercy of God vouchsafed to man by Jesus Christ served to soothe and tranquillize his mind.

In June 1764, he left St Alban's in the company of his brother, a clergyman and a fellow of Cambridge, who had procured an asylum for him at Huntingdon. Before he had lived long in this new residence, he was one day in his walk accosted by a young gentleman of engaging manners, who expressed a strong desire to cultivate his acquaintance, and who introduced him to his family, with which he ever after continued in close connection; for this stranger was Mr Unwin, afterwards rector of Stock in Essex; and his mother was the poet's Mary, who treated him as a son, and who was regarded by him as a mother. This family, consisting of the husband and wife, a son and a daughter, Cowper found so much to his mind, that, in the fulness of his satisfaction, he wrote to a friend that he believed he should find every place disagreeable that had not an Unwin belonging to it. About a year and a half after he became an inmate of this family, the elder Mr Unwin was killed by a fall from his horse, when the widow, her children, and the poet, removed to Olney in Buckinghamshire, where they arrived October 1767, and where the poet became acquainted with Mr Newton, then the curate of that parish, and afterwards rector of St. Mary, Woolneth, in London. The first five years of his recluse residence in this place, he seems to have spent in health and sweet serenity of soul. But in 1773, about which time his brother died, he sunk again into his former state of deep dejection, and continued in it for nearly eight years. But, even amid his melancholy, he was not destitute of the means of amusement; for this end he tamed hares, he corresponded with a few friends, drew landscapes, read history and biography, wrought in a garden, and produced occasional pieces of poetry.

In the winter of 1780, in compliance with the request of Mrs Unwin, his Mary, he engaged in good earnest in the composition of poetry for publication; and by March 1781 he had completed Table Talk, The Progress of Error, Truth, and Expostulation, which, with Hope, Charity, Conversation, and some minor poems, constitute his first volume. But before it issued from the press, which it did in March 1782, he was introduced to Lady Austin, a female of high spirits and lively fancy, whose cheerful conversation had the happiest influence on the desponding spirits of the poet. In one of their evening parties, she related to him the facetious history of John Gilpin, which he versified in bed the same night, and presented it to her next morning in the shape in which it has been so long and so well known to the public. This lady was a lover of blank verse, and requested Cowper to favour her with a poem in that species of composition, with which, though at first reluctant, he promised compliance provided she furnished the subject. "O," she replied, "you can never be in want of a subject, you can write on any,—write on this sofa." He obeyed, and from this little incident the world is indebted for the Task. It was at the suggestion of Lady Austin, too, that he engaged in the translation of Homer; and on the whole his time in her company seems to have glided happily away. In the morning he composed poetry and wrote letters; in the evening he read voyages, criticism, and "the folio of four pages," to the ladies. But the jealousy of Mrs Unwin induced a quarrel between these devoted females, which determined Cowper to forego the fascinating society of Lady Austin.

Next year he published the Task, and proceeded with the translation of Homer; next again, Lady Hesketh gave him her company, "a cordial, the effect of which he said he should feel while he lived;" and towards the end of that year he, his affectionate kinswoman, and the now enfeebled Mary, removed from Olney to the neighbouring village of Weston, where "he found himself situated exactly to his mind." In 1787, while the poet was ill of a nervous fever, Samuel Rose, Esq. in his way from the university of Glasgow to his residence in London, waited upon him, partly, as it seemed, to give him the thanks of the Scotch professors, and partly to gratify his own curiosity. From whatever motive Mr Rose made his visit, it was the means of introducing Cowper to the poetry of Burns, which he read with avidity and delight, and proved the commencement of a friendship which terminated only with the death of the poet. Two years after this incident, Mr Johnson, a young clergyman, and his kinsman by the mother's side, like Mr Rose introduced himself to Cowper's acquaintance, and like him, too, met with a welcome reception. This interview was also the foundation of a pure and permanent friendship. Johnson afterwards spent his academical recesses with his relation, and when absent at his college or his cure he maintained his intercourse by letter. In 1792 his correspondence with Mr Hayley, his affectionate and faithful biographer, commenced, of whom he says, in a letter to Lady Hesketh, "I account him the chief acquisition that my own verse has ever procured me." During this period, when health and spirits permitted, he was employed in the translation of Homer, in writing notes for Milton, and in composing a poem on the *Four Ages of Man*, which was never finished; but a great deal of his time was spent in mere moping and musing, and "*forecasting the fashion of uncertain evils.*" The clouds of dejection were now deepening over him with awful and overwhelming darkness, no more to be dissipated on this side of the grave. He declined an introduction to Gibbon, the historian, received the visits of his friends with apparent indifference, and heard the intelligence that his Majesty had granted him a pension with scarcely a token of emotion.

In 1795, he and Mrs Unwin, now a helpless paralytic, were carried, under the conduct of his kinsman, the Rev. Dr Johnson, from his beloved Weston to North Tuddingham, in Norfolk, where he found, in a Miss Perowne, a kind and careful attendant, whose assistance he ever afterwards preferred to all the numerous friends who were ready to minister to his wants and to alleviate his distress. In autumn his friend removed him to the village of Mundsley, on the Norfolk coast, thence to Dereham parsonage, and from that to Dunham-lodge, with little relief to his affliction. He seemed to be haunted with a dread lest he should be left alone, and took little interest in any thing except in listening to works of fiction, which his friend read to him incessantly, and which he heard with rivetted attention. It was afterwards discovered that he had pleasure in hearing the scriptures read, and could join with devotion in family prayers; and in 1796 the arrival of Wakefield's edition of Pope's Homer at Dunham-lodge, engaged him in the revision of his own. But his attention was soon dissipated, and no permanent abatement of his disorder took place. Yet he continued unremitting in his attention to the dying Mrs Unwin, and seemed aware that her dissolution was approaching, for, on the morning of the day of her decease, he said to her female attendant, "Sally, is there life above stairs." In the dusk of the evening, when admitted to view her corpse, he turned with an unfinished sentence of passionate sorrow, and never spoke of her more.

In this season of deep despondency he composed a Latin poem, entitled *Montes Glaciales*, which, at the request of Miss Perowne, he translated into English. Soon after he produced the *Cast-away*, founded on an incident recorded in Anson's voyage, which he had not seen for 20 years before. His attention was also recalled to Homer, and led him to new-model some passages of it; but these exertions, which were hailed by his friends as tokens of returning health and serenity, proved the last of his literary labours. In the spring of 1800 the strength of the pitiable sufferer declining apace, rendered him unable to bear the motion of a carriage; and after a few weeks of confinement to his room, on the morning of the 23d of April, he breathed his last, so imperceptibly as for some minutes to be unobserved by any of his attendants. He is buried in the church of East Dereham; a marble monument marks the place, and an inscription from the pen of Hayley records his exquisite fancy, and "his spotless fame."

Cowper was of a middle stature, rather strong than delicate in the form of his limbs; his hair was brown, and his complexion ruddy; in his dress he was neat, and in his diet temperate; his air was pensive and reserved, but his conversation was delicate and fascinating in the highest degree. His too feeling heart was early in life cruelly lacerated by a disappointment in love, an affection which flowed afterwards in the kindred channel of devotion. But though he has been branded as a sour sectary, it is well known that he continued through life deliberately attached to the established religion of his country.

His mental powers, when unsuspended by his dreadful disorder, were of the first order. Elegant simplicity of style, playfulness of humour, and sincerity of affection, appear in every page of his epistolary correspondence; and for accurate description, pure morality, as well as for variety of subject, elevation, and elegance of sentiment, his poetry is not surpassed.

CRACOW, the capital of West Gallicia, and now included in the Austrian territory, was formerly the capital of Poland, stands on an extensive plain on the banks of the Vistula, and although occupying a large space of ground, yet as the houses are thinly scattered, the population is not great. Many of the streets are spacious, and the great square is adorned with some excellent houses; but the ruins which everywhere appear, in consequence of the severe struggles with hostile powers, exhibit a striking contrast with the splendour and magnificence of the public edifices. The palace or citadel; the university, founded in the middle of the 14th century; the cathedral, containing numerous monuments to the memory of the kings of Poland; and the palace of Casimir the Great, are the principal public buildings.

The population of Cracow, which is said to have been equal to 80,000 in the 15th century, is now reduced to 24,000. The salt-mines of Wielickzka, in the vicinity of Cracow, are objects of great curiosity. These mines have been wrought for more than 600 years, in a mountainous ridge at the northern extremity of the chain which joins the Carpathian mountains.

CRAMBE, Sea-cabbage, or Sea-kale, a genus of plants belonging to the Tetradynamia class.

CRAMP, a spasmodic affection of the muscles of different parts of the body, and sometimes accompanied with severe pain. See Medicine.

CRAMP-FISH, or Torpedo. See *Raja*, under Ichthyology.

CRANE, a machine employed in raising or lowering heavy bodies, and commonly used for loading and unloading ships, or for depositing goods in, or removing them from warehouses, as well as for lifting large stones in the erection of buildings. See Mechanics.

CRANMER, Thomas, archbishop of Canter-

Cranmer. bury, and a martyr in the cause of reformation, was the descendant of an ancient family in Nottinghamshire, and was born in the year 1489. Having at school made uncommon proficiency in the attainment of classical learning, he was, in 1503, the 14th year of his age, admitted a student of Jesus college, Cambridge, where his great abilities and close application to his studies were quickly rewarded with a fellowship, which, however, he as quickly forfeited, in consequence of his marriage. But this union, in less than a year after its formation, was dissolved by the untimely death of his consort; on which (such was the opinion entertained of his talents) his college restored him to his fellowship. During his residence at Cambridge, he gave his attention by turns to the study both of literature and science, but theology and biblical criticism engrossed the largest portion of his time. After his reputation as a man of superior endowments, improved by study, and dignified by correctness of conduct, was fully confirmed, Cardinal Wolsey offered him a fellowship at Oxford, which he declined. In 1523 he took the degree of doctor in divinity; was appointed to lecture on theology, and to examine candidates for graduation. But the highway to preferment was opened to him by accident. Having retired to Waltham-abbey in Essex to escape the plague, which prevailed at Cambridge, Henry VIII. happened, in the progress of a tour through that part of his kingdom, to pass a night in the house of Mr Cressy, where Cranmer lived as an inmate. Dr Fox, the king's almoner, and Dr Gardiner, his secretary, were in his train, who, while in company with Cranmer at supper, conversed with him respecting the king's divorce from Catharine of Arragon, which the pope had refused to sanction. Cranmer, with the perspicacity for which he was distinguished, stated, that whether a man might marry his brother's wife, was a question which could be decided only by an appeal to the authority of scripture; that the decision of scripture on the point could best be ascertained by a reference to the learned men of the universities; and that when once ascertained, the pope's acquiescence in it must follow of necessity as a matter of course. Fox and Gardiner were struck with the acuteness of these remarks, and soon after imparted them to the king, with the name of their author, on which he expressed his satisfaction, saying, in his coarse way,—*the man has the right sow by the ear.*

Cranmer was soon after sent for to court, had an interview with Henry, was appointed one of his chaplains, placed in the family of the Earl of Wiltshire and Ormond, the father of Anne Boleyn, and enjoined to write on the subject of the divorce. In this work he acquitted himself with ability and success, making it evident, from the concurrent testimony of the word of God, of general councils, and of ancient writers, that the pope had no power to dispense with the dictates of scripture, a doctrine which he afterwards maintained at Cambridge in a public disputation, to the conviction of many of the learned men of that university, and in other parts of the kingdom. About this time he was presented to a living in the church, and made archdeacon of Taunton. In the year 1530 he was appointed one of an embassy to Rome, and the different courts of Europe, to discuss the subject of the legality of the king's marriage. While at Rome, though he failed in obtaining the pope's consent to the divorce, yet his Holiness conferred on him the office of penitentiary throughout England, Ireland, and Wales, with the view, no doubt, of conciliating his favour, and securing his interest, by checking the spirit of protestantism which he had already displayed. He went on his master's business through Italy, France, and Germany, and held in various places public disputations. During his stay at Nuremberg he married a second wife, the sister of the famous Osiander.

In 1532 he was nominated archbishop of Canterbury, the king having procured from the pope the bulls necessary for his consecration. But as he cherished, and had partially professed sentiments contrary to an implicit compliance with papal jurisdiction, he could not conscientiously swear the oath of obedience to the pope. As, however, he had no objections to the honours associated with the primateship of all England, and as he was unwilling to disoblige his royal patron, he had, with the view of quieting his conscience, recourse to a dangerous expedient. This was to take all the oaths in the manner in which they were prescribed, and then to enter his solemn protest against their obligation whenever they interfered with his duty as laid down in the word of God. This protest the reader will find recorded in the appendix to Strype's memorials.

In the same year in which he was made archbishop of Canterbury he pronounced the sentence of final separation between the king and the queen, for which the pope threatened him with excommunication, against which he appealed to the decision of a general council, and ever after disputed against the pope's supremacy, and promoted with all his influence the cause of the reformation. To this end he procured the translation of the Bible into English, which he caused to be disseminated through the country; forwarded the suppression of monasteries, and the dissolution of religious fraternities; and visited his extensive province, preaching wherever he came, that the bishop of Rome was not God's vicar on earth, that the holiness of that see was only in name; and that the laws of the pope had no title to the appellation either of *sacred* or *divine*. The good effects of these and similar exertions were, however, in a great measure counteracted by the enactment of a law, enforcing uniformity of religious opinions by pains and penalties, an enactment which, from the rigorous cruelty with which it was carried into execution, was justly called the *bloody statute*. In vain did Cranmer oppose the weight of his influence, and the force of his eloquence; it passed into a law, and was productive of incalculable mischief. On the suppression of the monasteries he wished to obtain salaries for a reader of divinity, of Greek and Hebrew, out of their revenues, and these professors to be attached to every cathedral in the kingdom; but this scheme miscarried as well as several others, which he proposed. But though the avarice and caprice of the king interfered with his beneficial designs, yet that monarch never withdrew from him either his confidence or his affection; he uniformly protected him from the machinations of his enemies, and sent for him on his deathbed. Before his arrival the king was speechless; but in token of his unaltered regard, he pressed the archbishop's hand, and then expired.

Cranmer was appointed one of the regents during the minority of Edward VI. but did not intermeddle much with politics. The reformation of religion from the errors of popery seemed from this period to have engrossed his attention; but the bigotry and malevolence of his enemies made it necessary for him to proceed with all the caution and circumspection of prudence. He composed, or caused to be composed, the homilies; revised and amended the offices of the church; established communion in both kinds; ordained many deacons and priests, whom he caused to be employed in frequent preaching. Through his care, the book of Common Prayer, with the articles of religion, then forty-two in number, was completed, and in 1552 was printed and authorised by parliament. About this time he impressed an indelible stain upon his character, by his relentless persecution of Joan Bocher, *the maid of Kent*. This woman, though in other respects perfectly correct and inoffensive in her conduct, had denied the divinity of Christ, for which in that arbitrary age she was condemned to the flames. At first Edward refused to sign her death-warrant; and when urged to compliance by Cranmer, he said that to burn a person for conscience sake too much resembled the conduct of the catholics, and asked the archbishop this emphatic question: *What, my Lord,—Will you have me send her quick to the devil in her error?* At length, however, persevering importunity overwhelmed the generous reluctance of the king; but while he signed the warrant for her execution, he protested with tears that he acted against his feelings and sense of justice. His conduct in the imprisonment of Gardiner and Bonner is also blamed as harsh, and savouring of personal resentment and of a persecuting disposition.

But on the premature and lamented death of Edward his power was brought to a speedy termination, and his sufferings augmented by every refinement of cruelty. On the accession of Mary, the Romish religion again attained the ascendant, and shed a baleful and withering influence on protestantism. But Cranmer, although he might have fled for safety, chose, against the urgent solicitations of his friends, to abide by his post. Bonner, now bishop of London, gave, on this occasion, full scope to his hatred toward the archbishop, by raillery and bitter reproaches; and in the circulation of a report that he had abjured his errors, as he was pleased to denominate the opinions which the archbishop had avowed, and at length sealed with his blood. Cranmer fell into this snare, and published a refutation of the calumny which was propagated against him. On this he was summoned before the Star-chamber, and contrary to expectation, was pardoned by the queen; but this lenity was a mere mockery, and intended to appear as an equivalent for his generous interposition with her father when he had resolved to put her to death. He was attainted, committed to the tower, and in 1554 he, with Ridley and Latimer, was sent to Oxford to maintain a public disputation with the papists. Some months after this he was condemned as guilty of heresy and blasphemy for his writings against popery,—of perjury for breaking his oath to the pope,—and of incontinency on account of his marriage. Bonner had the savage satisfaction of degrading him from the pontifical office, and of exulting over him in his fall; but the firm fortitude of the aged archbishop penetrated the heart of others who were present on the occasion, and who gave free scope to the feelings of humanity, and melted into tears.

After this ceremony he was sent back to prison, and flattered with the promise of pardon on the abjuration of what was called his errors; and the old man, immured in the dreary solitude of a prison, and urged by the ceaseless solicitations of his apparent friends, but concealed enemies, lost his courage, and, in the moment when his heart misgave and his fortitude failed, he signed the recantation of the principles and conduct which he had formerly maintained. This step, while it grieved the friends of the reformation to the heart, was a source of joy to the abettors of popery; they caused the recantation to be printed and widely circulated, and resolved that its author should be executed before he could have time to repent.

On the 21st of March 1555, he was led in tattered garments to St Mary's church in Oxford, where Dr Cole, provost of Eton, was appointed to deliver a sermon, which the preacher closed by commanding the degraded primate to read aloud the abjuration of the errors, the recantation of which he had already signed. In answer to this mandate, the archbishop, whose silent sorrow was mistaken for contrition, said in a dignified manner and with a firm voice, that he believed all the revelations of Scripture, and bitterly deplored that in opposition to truth and the dictates of conscience he had so recently abjured the views of religion which he had embraced on mature deliberation. This was a declaration for which the spectators were not prepared, and expressed their surprise and disappointment in the bitterest execrations. Dr Cole exclaimed to stop his mouth, to pull him down, to drag him to the flames. He was chained to the stake, and took farewell of his murderers; and when the flames were rising around him, he stretched out his right hand, and exclaimed, *This is the hand that did it.* Once he drew it across his forehead, and then exposed it to the devouring fire till it dropped from his shoulder. He stood with firm fortitude amid the flames till his vitals were consumed, when, with his eyes uplifted to heaven, he expired with the words of Stephen on his lips, Lord Jesus receive my spirit.

CRASSULA, Lesser Orpine, a genus of plants belonging to the Pentandria class, and of which Crassula Coccinea is deservedly admired on account of the rich scarlet and delicious fragrance of its flowers.

CRATÆGUS, Wild Service Tree, and Hawthorn, a genus of plants belonging to the Icosandria class, and of which the white thorn is familiar to every one on account of its general use as a quick fence.

CRATÆVA, the Garlic Pear, a genus of plants belonging to the Dodecandria class.

CRAX, the Curassow Bird, a genus of birds belonging to the order Gallinæ. See Ornithology.

CRAW or CRAY-FISH, a species of Cancer, which see under Entomology.

CREDITON, pronounced shortly Kirton, is a town of Devonshire in England, stands on the banks of the river Creedy, is about a mile in length, and contains nearly 2000 inhabitants, who are chiefly engaged in the manufacture of serges and other woollen stuffs. The market for wool and yarn is considerable. The altar-piece of the church, a Gothic structure, is much admired on account of an excellent painting, which represents Moses and Aaron supporting the Decalogue.

CREECH, Thomas, the translator of several classical authors, was a native of Dorsetshire, and was born in 1659; was educated at Sherborne, his native place, and afterwards at Oxford; and was, first known by his translation of Lucretius. In 1699, he took orders, and was presented to a living in Hertfordshire; but, in the succeeding year, he was led from some cause not explained to commit suicide. Beside Lucretius, Mr Creech translated Horace, the Idyls of Theocritus, the Astronomicon of Manilius, and some parts of Virgil, Ovid, and Plutarch.

CREED, a brief summary of a Christian's belief, of which different forms have been adopted in different churches. The most universal creeds are, the Apostle's creed, the Athanasian creed, and the Nicene creed, all which are used in the public service of the Church of England, and to which subscription is required by the established Clergy.

CREMONA, a town of Italy, is situated in a fine plain, which is traversed by the river Oglio, and not far distant from the north bank of the Po, covers a space of five miles in circumference, has wide and straight streets, and is adorned with squares, palaces, and churches, some of the latter of which, as the cathedral, are furnished with excellent paintings.

The population is stated at 21,000; the manufacture of knives was once considerable, and the violins and other instruments of music have been long in high repute. Silk, corn, flax, oil, honey, and parmesan cheese, are exported and exchanged for linen cloth, sugar, and coffee.

CREPIS, Hawkweed, a genus of plants belonging to the Syngenesia class.

CRESCENTIA, the Calabash Tree, a genus of plants belonging to the Didynamia class; one species of which furnishes, from the shelly covering of the fruit, bowls, cups, and other utensils to the inhabitants of Africa, and the negroes of the West Indies. See Botany.

CRESS, the English name of several plants, as the common garden-cress, a species of *lepidium*, water-cress, or *sisymbrium aquaticum*, and Indian-cress, *tropæolum majus*.

CRESSY, a port-town of Picardy, in France, about 44 miles south from Calais, and famous in history on account of the splendid victory which Edward III. of England obtained over the French on the 26th of August in the year 1346. In this decisive victory, beside the king of Bohemia and 11 other princes, 89 bannerets, 1200 knights, 1500 gentlemen, 4000 men at arms, and 30,000 soldiers, on the part of the Franch, were slain on the field.

CRETE, the ancient name of the island of Candia, in the Mediterranean, which held a conspicuous place in the history of the Greeks and Romans. See Candia.

CREUSE, a department of France, so named from a river which runs through it, and which falls into the Vienne, one of the tributaries of the Loire, comprehends the greater part of the ancient province of La Marche, is about 20 French leagues long, and 19 in breadth, extends more than 2200 square miles in surface, and contains above 220,000 inhabitants. The country is rather flat, pretty well watered by the greater and little Creuse, the Taurion, Gartempe, and other streams, and is on the whole tolerably productive of grain and fruit. Coal and marble are among the mineral products. This department is divided into four circles, viz. Gueret, Boussac, Aubuisson, and Bourganeuf.

Gueret, the capital, is only a small place containing little more than 3000 people, near the origin of the Gartempe, about 170 miles south of Paris.

Boussac, also a small town 25 miles north-east of Gueret, is defended by a wall, and a castle built on a rock, on the banks of the little Creuse.

Aubuisson, on the Creuse, 37 miles north-east of Limoges, contains about 4000 inhabitants, and is noted for its tapestry and carpet manufactures.

Bourganeuf, situate on the Taurion, 20 miles north-east of Limoges, contains about 2000 inhabitants. It is remarkable for the tower of Lizim, the brother of Bajazet II. emperor of the Turks, built by him during his exile.

Of the other towns in this department may be mentioned,

Benevent, containing about 2000 inhabitants, two leagues from Gueret, and noted for a rich Augustine abbey.

Felletin, where there is a manufactory of tapestry, 21 miles S.S.E. of Gueret, and in whose vicinity are mineral springs.

Ahun, S.S.E. of Gueret, a town containing 1200 inhabitants.

CRICHTON, James, one of the most celebrated Scottish characters of the 16th century, and, from his remarkable personal and mental endowments, denominated the *Admirable Crichton*, was a native of Perthshire, and descended from a respectable and probably opulent family. The time of his birth is uncertain, but is generally supposed to have been about 1560. He received the rudiments of his education at Perth, and completed it at St Andrews, then pre-eminent among the three Scottish universities as a school of philosophy and languages. Under the direction of Buchanan, then principal of St Leonards, the elder Robertson, and other celebrated professors, Crichton made the most astonishing progress in literature, and what was at that time called philosophy. Gifted by nature with splendid talents and a most retentive memory, he quickly outstripped all his competitors for fame, and, by the time he reached his 20th year, was regarded as a prodigy of learning. It is said that he could speak and write with fluency in twelve different languages, viz. Hebrew, Arabic, Syriac, Greek, Latin, French, Italian, Spanish, Dutch, Flemish, Sclavonian, and English; that he was a profound mathematician and logician; and that he composed equally well in verse and prose. What is still more extraordinary, he was a proficient in all the liberal arts, and excelled most of his cotemporaries in the polite accomplishments of music, dancing, fencing, riding, and tilting. It is probable that the accounts handed down to posterity of this remarkable character are a good deal exaggerated; but enough yet remains of what can scarcely be disputed to render him an object of admiration.

After completing his education, Crichton set out on his travels to the continent of Europe, and visited the principal courts and seats of learning, especially Paris, Rome, Venice, Padua, and Mantua. Wherever he went, he entered into disputations with the literati of the place; engaged in tilting matches; challenged and overcame the principal prize-fighters of the times; and even composed and acted dramatic pieces. Victory and success attended him in every contest; and what astonished all who witnessed his triumphs, and mortified his vanquished rivals, he seemed to gain the victory without previous study or preparation; for while his competitors were labouring with anxious care and beating hearts to prepare themselves for the day appointed, Crichton passed his days in hunting and riding, and spent his evenings at balls and concerts.

The fame of his exploits, and the circumstance of his having defeated a notorious gladiator, attracted the notice of the duke of Mantua, and induced him to offer Crichton the honourable post of tutor to his son, Vincentio de Gonzaga. The accomplished young Scotsman was highly flattered by this testimony to his talents, but had too soon reason to repent his having accepted the situation. The prince, whose natural disposition appears to have been cruel, jealous, and vindictive, either envious of his tutor's reputation, or, what is more probable, stung with jealousy at the effects of his superior personal attractions, conceived against him the most implacable hatred, and employed ruffians to way-lay and assassinate him. During the carnival of 1582 or 1583, while Crichton, with unsuspecting confidence, was wandering through the streets of Mantua, playing on his guitar, he was suddenly set upon by Vincentio and his bravoes masked. He defended himself with his usual skill and coolness, put to flight the bravoes, and disarmed their leader, who then discovered himself, and sued for mercy. Shocked and confounded at finding an assassin in the person of his pupil, Crichton, with that imprudent generosity which distinguished the age of chivalry, presented his own sword to Vincentio, and stood defenceless before him. The dastardly villain snatched the offered weapon, and sheathed it in the bosom of his victim.

Crichton is said to have been one of the handsomest men of his time; and he seems to have owed much of his celebrity to the ease, address, and confidence with which he acted on all occasions. His literary talents, as far as they can be appreciated from the writings that are attributed to him, were rather showy than profound; and the essays and poems which he composed were remarkable for little but a fluency of style which captivated his hearers, and an ingenuity of reasoning which rather dazzled than convinced.

CRICKET, a species of insect,—see *Gryllus*, under ENTOMOLOGY: And mole-cricket—see *Gryllotalpa*, under ENTOMOLOGY.

CRICKET, a favourite game in England, which is played with a ball and bats. See GAMES.

CRIMEA, a large peninsula of Europe, forming a province of the Russian empire, lies chiefly between the 44th and 46th parallels of north latitude, and the 32d and 37th of east longitude, and, except at the isthmus of Perecop, which connects it with the continent, is entirely surrounded by the marshes of Azof or the waters of the Black sea. This peninsula was the Taurica Chersonesus of the ancients; in more modern times it has been denominated the island of Caffa, and Crim-Tartary; and since it came under the dominion of the Russians, who affect classical designations, it has, in conjunction with some other districts, been called Taurida.

Aspect.—When the Crimea, which spreads over a surface of at least 5500 square miles, is surveyed from the north, it wears a very "dull, flat, and unprofitable" appearance. The traveller, as he directs his course towards the peninsula, along the isthmus, which is about four miles in breadth, has the sivash, or putrid marsh, on the east, and a large gulf of the Black sea on the west, both in sight, and exhaling, especially the former, the most obnoxious vapours. When he enters it, he will find himself surrounded on all sides by saline lakes and pools, and see a desert stretching before him, and extending on his right hand and on his left far beyond the sphere of vision; so that, in whatever direction he journeys onward, he will find himself fatigued with the same sombre uniformity of landscape. But as he advances he will ascend by a gentle slope the acclivity of the mountains which line the southern shore, and look down upon the delicious vallies embosomed in their recesses, and washed by the waves of the Black sea. For, notwithstanding "the inflated descriptions which have been published of the scenery of the peninsula, so narrow is the tract of cultivated land upon the southern coast, that it may be compared to an edging of lace upon a large apron."

Mountains and geology.—The rocky barrier, which, in parallel ranges running from east to west, lines the southern shore, rises to the elevation of 1000, and in some of its points of 1200 feet, above the surface of the sea, and retains the snow on some of its summits till towards the month of June. These mountains on the south side are all broken abruptly, as if by the sinking of the main bed into the sea, while their northern declivity is extremely gradual. They are composed almost entirely of calcareous rocks; those on the coast are of red and white marble, full of cracks and fissures, but well adapted for quarrying; in some places the marble pillars alternate with others of trap, clay, common limestone, and schistus, which exhibit the appearance of books ranged in a library. The northern steppes, or plains, are formed of a soft calcareous deposit in a series of depressed surfaces, sinking towards the south, and mixed with marine remains that relate chiefly to animals now unknown. The shore is covered with fine gold-coloured micaceous sand; and yet notwithstanding the great elevation of some of the mountains, which abruptly project into the sea, no primitive rocks have been detected among them, or in any other part of the peninsula.

Rivers and lakes.--Compared with the rivers of other countries, the streams of the Crimea dwindle into mountain torrents. The Salger, the largest of them, flows over a stony bed, in a north easterly direction, toward the sea of Azof; it is fordable in summer, but when swelled with the rains of winter and the melting of the snow in spring, it becomes deep, broad, and impetuous. The Belbek, the Katsha, Alma, and the Balganack, with some others, which have their short but rapid course through the southern vallies, roll on with much magnificence in winter, and in summer degenerate into insignificant brooks. The extensive steppes of the north are in general destitute of streams; but on the western coast, in the district of Perecop, and along the shore of the Sivash, are chains of saline lakes, and bays which deposit salt in such extraordinary abundance that, like sand, it is stowed into ships, or filled into waggons, and carried over all Turkey and Russia.

Natural divisions.—The Crimea, though in general extremely compact and regular in its form, has yet some curious excrescences, which deserve to be noticed. On the east a portion of it juts out between the Black sea on the south and that of Azof on the north, toward the island of Taman on the east, from which it is separated by the Cimmerian Bosphorus, forming a subordinate peninsula, known by the name of Kertsch. From the isthmus of Arbot, the narrowest part of this tract, a line-like stripe of land branches off toward the north, between the sea of Azof on the east and the Sivash, or Putrid gulf, on the west, and runs out, seldom more than a mile and a half in breadth, to the length of seventy miles. This shred of land is composed of testaceous and common sand, and is frequented by carriers from Little Russia, bringing commodities which they exchange for fish and salt.

Climate.—The Crimean spring, from March to May, is represented as a most delightful and salubrious season. The heat is moderate and refreshing, and the nights are cool and serene; the senses are soothed with the music of the grove, and with the rich variety and fragrant odours of plants and flowers. But the summers are irregular. Long droughts parch the verdure of the hills, and thunder-storms, accompanied with hail and heavy rains, occasionally intervene with an alarming and destructive influence. The autumns are unhealthy, and then fevers and agues are common, and frequently fatal. In winter the mountains are covered with snow, and the weather in the plains is sometimes extremely severe. The winds are very variable, and bring rain from the west, mild air and mists from the south, serene dry weather from the east, and cold from the north. In the year 1800, from the 20th of July to the 10th of October, the range of Fahrenheit's scale was, according to a register kept by Dr Clarke, between the 90th and the 53d degrees.

Productions.—The botany of this part of the Russian empire has been investigated by the celebrated Pallas, with his usual minuteness and accuracy; and, of the trees and shrubs which occur most frequently, he enumerates the mountain-pine, the juniper, the yew, and a few other evergreens; the oak, the beech, the elm, several species of poplar, the linden, the maple, and the ash, as its prevailing timber trees; a great variety of wild fruit trees, and also of shrubs; of those that are cultivated in orchards, he mentions pears, apples, quinces, plums, peaches, apricots, cherries, several sorts of mulberry, walnut, hazelnut, and chesnut trees. Vines grow wild among the mountains, and are extensively cultivated in vineyards. In the gardens great quantities of water-melons, melons, gourds, cucumbers, and culinary plants in vast variety, are raised with little labour. Wheat, rye, barley, oats, maize, millet, pease, flax, and tobacco, are grown in the fields. Wild sage and thyme are the prevailing plants of the mountains; and many parts of the steppes yield a rich and luxuriant pasturage.

Among the quadrupeds of the country are large camels with two bunches, horses of an elegant and fleet breed, horned cattle, small buffaloes, three varieties of the sheep, goats, deer, hares, wolves, foxes, badgers, weasels, dogs, and jerboas. The feathered tribes are not numerous, and consist of crows, owls, thrushes, blackbirds, partridges, quails, kingfishers, pigeons, and poultry; the goose, the swan, the duck, the teal, with gulls of several sorts, serpents, lizards, and frogs, especially the last, are common. The *rana variabilis* which swarms on the shores of the Sivash, has a most disgusting appearance, and always indicates unwholesome air. The scorpion, the *tarantula* spider, and the *scolopendra*, are found in the dwellings of the Tartars, and are dangerous. Caterpillars and locusts are very destructive to the vines, the fruit trees, and even the corn fields. Bees are abundant, and produce excellent honey, and a great deal of wax. The rivers are not prolific in fish, but great store and variety haunt the shores, among which are two sorts of sturgeon, shoals of mullet, mackerel, and herrings, as well as oysters, and other shell-fish.

Inhabitants.—According to Pallas, the population of the peninsula, previous to its subjection to Russia, amounted to something more than half a million, but since that event, by the removal of many thousands of Greeks and Armenians to the country beyond the sea of Azof, and by the emigration of many thousands of Tartars, it has been diminished to 157,125 souls. These consist chiefly of Tartars, Russian colonists, gypsies, and a few slaves. The Tartar inhabitants may be divided into three classes; Nogays, the unmixed descendants of the Mongols, who, under Gengis Khan, first invaded the Crimea; the inhabitants of the northern steppes, who devote themselves chiefly to the rearing of cattle, and live in hovels of unbaked bricks, and use dried dung for fuel. The third class comprehends the inhabitants of the southern vallies; they are a mixed race, and are engaged in a great variety of employments. The houses of many of them are partly excavated from the rocks against which they are built; they have flat roofs, and are covered with earth, but smooth, firm, dry, and covered with carpets. The meanest cottager has in his house an apartment for himself and his guests, and another for his women, into which his most intimate friends are never admitted. We are told by Clarke, that these cottagers are cleanly, while at the same time they are covered with itch, and their houses are overrun with poisonous insects and vermin. In summer they spend a great deal of their time in the open air, and have both their feet and legs uncovered. They all shave their heads, and cover it with a scull-cap in the house, and over it a turban, or a thick quilted cap, out of doors, according to the season. The legs and feet of the better sort are dressed in boots of Morocco, or other leather, over which in wet weather clogs or stilt shoes are worn. They have loose trowsers, a shirt with long sleeves, a waistcoat of silk or cotton, and an upper robe which reaches to the calf of the leg. Young women wear wide drawers, a shift reaching to the ancles, divided before, and drawn together at the neck; a gown open in front, made of striped silk, with long sleeves, and adorned with broad trimmings embroidered with gold; they have also an upper robe with short thick Turkish sleeves, edged with ermine fur, or gold lace, and fastened with an ornamented cincture buckled in front. Married women cut off their hair obliquely over their eyes, and leave two locks hanging down their cheeks; they likewise bind a stripe of cloth round the head, within the ends of which they confine the rest of the hair, and turn it up from behind, braiding it into two large tresses. They paint their faces and stain their nails, and sometimes the wrists and the ancles.

The nobles, (Moorza, corresponding to the Persian Mirza,) dress in the Circassian fashion. They sometimes delight in strong contrasts, such as opposing silver lace to black velvet, but drab is their favourite colour, and they are in general remarkable for simple elegance and cleanliness. These *noble lords* were, till lately, so ignorant that they could neither read nor write, and instead of signing their names made an impression with their rings; but since their intercourse with Russia they have begun to apply to letters. Still, however, they dream away a great part of life in listless inaction, except when the chase rouses them from their habitual inactivity.

The food of the Crimeans, considering their barbarous condition, is both various and abundant. *Sarma*, that is forced-meat balls, wrapped in green vine or sorrel leaves, is regarded as their greatest delicacy; cucumbers, quinces, apples, and other fruits stuffed with minced meat, are also seen at their tables. Colt's flesh is considered as a dainty. Rice, boiled with meat, bread of unmixed flour, various preparations of eggs, butter which they preserve in the stomachs of oxen, and what they call *bulgur*, made either of dried or bruised unripe fruit, accompany most of their meals. They drink water with cheese dissolved in it, strong beer made from millet, and a spirituous liquor distilled from plums, sloes, and wild grapes.

Gypsies are much encouraged by the Tartars, who allow them to encamp in the midst of their villages, where they exercise the several functions of smiths, musicians, and astrologers. Many of them are wealthy, possessing fine horses, and plenty of other cattle; but this way of life, whether rich or poor, is always the same. They carry in their waggons drums of an enormous size, and a loud intimidating sound, which is accompanied with a pipe when performing before the village dancers. Their tents are abominably filthy, and their bodies covered with itch.

Rural Economy.—The cultivated, and of course the most thickly inhabited, part of the peninsula, is confined almost entirely to the southern shore, guarded by high mountains on the one side, and by the sea on the other. The vallies between the lateral ranges of these mountains are traversed by brooks and rills; they are of a heavy marl, a white sandy clay, or of a friable earthy soil, and are fitted to yield all the products of Italy or Greece. The fields, meadows, vineyards, orchards, and gardens, are enclosed with dry walls of rough stones. The plough in use has a broad share, and two wheels, and is drawn by oxen. The land is manured every third or fourth year, and is sown successively with millet, wheat, rye, or barley. The corn is separated from the straw by the treading of horses. A stake is driven into the ground, a cord is fastened to it, and to the other end of the cord a horse is yoked, and driven round on the sheaves till it is wound up on the stake, when he is turned and driven round in the opposite direction till it is wound off again, and thus he traverses the sheaves till they are thrashed. The vine is cultivated in various ways. In the vineyards on the banks of the rivers the roots are covered with soil during winter, and the vines are trained in the manner of bushes. In the southern dales they are planted in small oblong trenches, with drains to admit and carry off the water. Numerous orchards occupy the low ground along the brooks and the vallies furnished with a spring; the trees are scattered irregularly over a fine sward, and are watered by means of canals. The Tartars have a curious mode of keeping bees. They make cylinders of trees of six inches diameter, and pile them in their gardens horizontally, and when they want fresh honey, they open one of the excavated trunks, drive off the bees with the smoke of burnt paper, and abstract what they require.

Towns.—*Batchisarai*, literally the palace-garden, was the capital of the khans. It occupies the craggy sides of a prodigious fosse between two high mountains, somewhat like that of Matlock in Derbyshire. The view breaks at once on the traveller, exhibiting a variety of objects in a most irregular and scattered manner, while bubbling fountains, flowing streams, hanging vineyards, and terraced gardens interspersed with groves of black poplar, soften the horror of the rocks, and give the scene an inviting appearance. A rivulet which descends through the valley divides the town into two parts, the streets of which are mean, tortuous, narrow, and excessively dirty; but the towers, mosques, and chimnies of the houses, mingling with the poplar trees, give the whole an air of grandeur. The palace of the khan stands towards the western extremity of the town, in the side of the valley which fronts the south, and consists of different buildings arranged around small courts, without order.

The town has about 6000 inhabitants, consisting of Tartars, Greeks, Armenians, and Jews. Not far from the town is a large iron ring fixed into the rock, to which it is said vessels were once moored, though it is now far distant from the shore, and high above the level of the sea.

Akmetshet, where the Russians have fixed the seat of the provincial government, and revived the ancient Greek name Sympheropol, is beautifully situated on the banks of the Salgir, and surrounded by meadows and gardens. Like other Tartar towns, it exhibits throughout narrow streets, crossing each other at irregular angles. Many of the houses are built within high mouldering walls, so that a stranger is apt to imagine that he is wandering among ruins. The new town, planned and commenced by the Russians, is making no progress.

Aktiar, supposed to be the Ctenus of Strabo, stands on the southern coast; it consists of a broad street, has two churches, one of which is handsome; it has also shops, magazines, and barracks. The harbour is good, and the stairs of the quay are spacious and magnificent. The ancient city Chersonesus stood in this neighbourhood, which is thickly strewed with ruins.

Inkerman, situated on a river which falls into the harbour of Aktiar, flowing through perhaps the most beautiful valley of Europe, consists of chapels, monasteries, cells, sepulchres, and other caverns, hewn out of the solid rock in a manner fitted to astonish and confound the beholder.

Balaclava stands in a wild gigantic landscape, comprehending mountains, ruins, a harbour, houses covered with vines and flowers, or overshadowed by the thick foliage of mulberry and walnut trees. The port from the town seems a lake, land-locked by high precipitous mountains, but affords good anchorage. The town is inhabited by Greeks from the Morea, a set of daring pirates, to whom the place was assigned by the Empress Catharine for services rendered in her wars with the Turks. The streets are narrow, and paved with white and red marble. Vines fruitful in grapes cover the porticos of the doors, and all sorts of fruit are plentiful. The inhabitants have no foreign commerce, and lead an idle life. Caffa, Kirtish, and Yenekale are nearly in a state of ruins, though they were once large and flourishing cities. The strong fortress of Yenekale commands the straits of the Bosphorus. Perecop has only a few houses, and a small barrack, and is remarkable only for its fortifications and high wall from sea to sea.

Many villages are scattered over the southern vallies, embosomed in vineyards and orchards; of these, Baidar which stands in a valley of the same name, ten miles in length and six in breadth, in which the eye roams over meadows, woods, corn fields, and gardens, has been celebrated for the peculiar richness and beauty of its situation.

Manufactures and commerce.—The red and yellow Morocco leather of the Crimea is in no respect inferior to that of Turkey, and is used in the country for horse equipage, and boots for the inhabitants; a considerable part of it is also exported to Russia. Knives, swords, and cutlery are manufactured in Baktcheserai, and are highly esteemed for their excellent temper. Felt cloaks, soap, earthen-ware, tiles, and pipes for conducting water, are prepared in several of the towns, where also saddler's and shoemaker's work is neatly executed. The Tartar mountaineers furnish the market with wheels of all sizes, strongly but rudely constructed. Of late years a good deal of soda has been made; and, on the banks of the Salgir, the Tartars still manufacture saltpetre. Salt, grain, hides, butter, and soda are the principal articles of export; and the principal imports are raw and manufactured cotton, silk stuffs of various patterns and in the eastern fashion, the wines of the Archipelago, brandy, Turkish leaf tobacco, and a variety of fresh and dried fruits.

History.—The ancient inhabitants of this peninsula are called in the classic authors Cimmerii and Tauri, who were long held in annoyance, and at last driven to the mountains by the Scythian hordes. About 550 years before the Christian era, the southern and the eastern parts were colonised by the Greeks, and the kingdom of Bosphorus established. It was afterward the scene of much contention, and came successively under the sway of Mithridates, king of Pontus, and the Romans, led on by Pompey. The Alani, the Goths, and the Huns were by turns its next masters, down to the year 840 of the Christian era, when, with the adjacent countries, it was conquered by the emperor Theophilos. While the Khatyrians, the Kanglians, the Homanions, and other barbarous tribes were contending for the supremacy of the peninsula, the Greeks, by the peaceable pursuits of commerce, raised the town of *Sugdaya* to so high a pitch of celebrity, that all their settlements in that part of the world were distinguished by the name of *Sugdania*.

In 1237 the Crimea was invaded and subdued by the Mongol Tartars, who made it a province of their western empire, and peopled it with their roaming tribes. Not long after this period the Venetians established several commercial stations on the coast, and carried on a lucrative trade with Taman and all the neighbouring country, till they were supplanted by the Genoese, who obtained the permission of the Mongols to take possession of Caffa, supposed to be the ancient Theodosia. These enterprising merchants rebuilt and fortified this town; and made it the centre of the overland trade which they carried on with Persia, India, and China; but after the discovery of the passage to the East by the Cape of Good Hope, this trade declined. In 1441 the peninsula came under the power of a race of khans, of the house of the celebrated Gengis, who were soon subdued by the Turks, who completely ruined the commerce of the Black sea in all its branches; and it continued in this state with few changes till 1774, when, through the intervention of the empress of Russia, it regained its independence. But in consequence of a civil war having broken out between the Tartars, it was in 1784 reduced to the condition of a province of the Russian empire, a state in which it still continues.

The numerous ruins strewed along the coast of this country, so interesting to the man of classic taste, have not hitherto been examined with accuracy. *Travels* of Pallas and Clarke, and Tooke's *Russian Empire*.

CRINUM, Asphodel Lily, a genus of plants belonging to the Hexandria class.

CRITHMUM, Samphire, a genus of plants belonging to the Pentandria class, and of which *crithmum maritimum*, a native of Britain, is employed as an excellent pickle.

CROATIA, once a part of Illyricum, and now of the kingdom of Hungary, is traversed by the 45th parallel of north latitude and the 16th of east longitude, and is bounded by Hungary on the north, Sclavonia and Bosnia on the east, Dalmatia and the Adriatic on the south, and Carniola and Styria on the west. It extends in length from south to north about 150 miles, and in breadth from east to west about 100; and exhibits a surface of 10,700 square miles.

Physical state.—The surface of this tract is greatly diversified by mountainous ranges, with their intervening vallies, torrents, and streams. Of these ranges the *Velebitsh-Geberg*, which stretches in a south-easterly direction, partly along the shore of the Adriatic, presents a series of serrated elevations, and a great variety of the steepest precipices, many of its summits rising six thousand feet above the level of the sea, and the whole range, which is 80 miles in length, being filled throughout with high and beetling cliffs. In the military district of *Carlstadt*, the mountains of *Plissivicza* attain to a still higher elevation, and present an aspect still more rugged. The mountains of *Kapella*, *Merzlavod*, Sichelbourg, Verbaco, and some others, though extensive ranges, are far inferior to those which have been described. Numerous lakes are dispersed among the ravines of these alpine regions, the most considerable of which is a chain of lakes, eight in number, in the pent-up vallies of Kapella, which communicate with each other by stupendous cataracts. The principal rivers are the Drave, the Save, the Zermania, the Reka, the Unna, the Culpa, and the Sluinchieza. The Drave rises in the Alps of Tyrol, and flows with a rapid course towards the Danube, forming the line of demarcation between Hungary and Croatia. The Save has its source among the mountains of Carniola, receives many streams from both sides of its course, and at last joins the Danube near Belgrade. The Zermania and the Reka flow from the Velebitsh mountains and fall into the Adriatic sea; and the rest of the rivers of the country, after traversing their respective districts, are absorbed by the Drave or the Save.

The mineralogy of this region contains great variety both of primary and secondary rocks, with beds of iron, copper, and lead ores; gold is gathered in the bed of the Drave; beautiful marble is so abundant, that the parapet walls of the bridges of the country are built of it; salt, sulphur, vitriol, and coals belong to the list of its minerals. It has a salt spring, mineral waters, and hot wells, frequented by different classes of invalids and fashionable loungers. The climate, as the unequal surface of the country sufficiently indicates, is extremely various. Snow is seen on the heights for eight or nine months of the year, and in some of the ravines it never melts. The prevailing winds are from the north-east and the south-west; on the coast the weather is commonly wet and windy the one-half of the year, and parched with a withering drought the other; but some of the sheltered dales enjoy a serene and balmy breathing atmosphere, equal to what is experienced in Italy. Much of the soil, as usually happens in rocky regions, is of a sterile quality; yet extensive tracts stretch back from the banks of the larger rivers, enriched by alluvial depositions, and fitted to reward the labours of cultivation. Many of the mountains, and some of the plains, are covered with thick and tall forests of beech, oaks, pines, and poplars; and in other places corn-fields and pasture-lands, orchards, and gardens diversify the landscape.

Inhabitants.—The population of Croatia is said to amount to 765,000 souls, employed in the cultivation of the soil, or in the manufactures and commerce of the country. They are represented as a hardy race, inured to toil, and actuated by the spirit of independence. The inhabitants of the plains, however, have, it is said, in consequence of their intercourse with strangers, and through the enervating influence of premature marriages, greatly degenerated, both in respect of their physical and moral qualities, from the intrepid sons of the mountains. Their houses are constructed of wood, without windows or chimnies, and sometimes the progenitors and the offspring of three or four generations inhabit the same hovel, living together in the utmost harmony, the young yielding the old an implicit obedience, and treating them with deference and respect. They sleep on the ground; and a low table, a large trunk, a kettle, a few earthern pots and porringers, some wooden spoons, and one or two hatchets, compose their household furniture. Their dress consists of a shirt with large sleeves, a vest with a double row of buttons, white pantaloons, short woollen stockings, and sometimes Hungarian boots. In a belt they carry their knives and pistols, and wear a red cloak over all. Pelisses, rings, and other ornaments, as they are suggested by taste, or introduced by fashion, distinguish the rich. Oatmeal pottage, seasoned with butter or oil, oatmeal cakes, cheese, and potatoes, are the principal articles of their food. They eat little animal food in any part of the year, but during Lent they live entirely on milk, roots, and herbs. With the exception of a few Jews, they are Christians of the Roman or Greek church; the former are the more numerous class, and are under the spiritual inspection of the bishops of Agram and Zengg. In the civil department of the country are 35, and in the military districts 53 public schools, besides the academies of the towns and private schools in different places, and yet ignorance is said to be very general both among the people and the priests.

Rural economy.—The land is generally cropped for three years, and then left in fallow to recover its strength. Wheat, rye, maize, millet, oats, barley, and potatoes are the principal crops. Hemp and flax are also cultivated; cattle, sheep, goats, swine, and great numbers of turkies are reared; bees and silk worms have likewise been attended to, and turned to good account; apples, pears, cherries, olives, and figs are raised in the orchards, and the vine is cultivated in different districts with great success. Government has enforced the cultivation of potatoes and the propagation of fruit-trees, by the infliction of a certain number of strokes of a cudgel on such as shall neglect those branches of industry.

Divisions and towns.—The whole of this part of the Austrian dominions is divided into two departments, the civil and the military. The former comprehends the maritime districts, and the counties of Waradin, Agram, and Kreutz; and the latter the districts of Carlstadt, Balnagranze, and military Waradin; all of which are subdivided into districts of regiments. The country is said to contain 13 cities, 13 towns, and between 3000 or 4000 villages. Many of the cities and towns, however, compared with those of other countries, must be extremely small; Zengg contains only 2744 inhabitants. It is the seat of a bishop, has many churches and convents, and is well defended by fortifications. Agram, situated on the Save, is also the seat of a bishop, and has 9000 inhabitants. Carlstadt stands on the Culpa, 175 miles distant from Vienna; it is defended by a fortress, and is the capital of the military districts. Waradin, on the Drave, is a strong town, with 4000 inhabitants. Fiume, seated on the sea shore, has a good harbour, and is noted for churches and convents, for wines and fruits.

Manufactures and commerce.—The peasantry, a proof of their half civilized condition, generally make their own clothes, household furniture, and implements of husbandry; and even the towns can boast of few professed artizans. Yet in Fiume are manufactures of leather, cordage, hats, snuff, stoneware, sugar, liquors, and cloth, as well as dock-yards for ship-building. Zengg has sail, anchor, and cordage manufactories; and in the other towns are iron and copper forges, potteries, glass-works, and saw-mills. The principal articles which the Croatians have to dispose of to their neighbours and foreign merchants, after supplying their own wants, consist of wool, wood, cattle, corn, and fruit, which they exchange for money and other goods with the Turkish, Austrian, and Venetian merchants. A great deal of Hungarian corn, tobacco, manufactured, and in leaves, refined sugar, honey, wax, wood, glass, and a variety of other articles, are exported from Fiume and the other ports on the coast; and at the same places salt, brown sugar, Dalmatian wine, oil, maize, rice, coffee, cotton, linen, and paper are imported. Croatia is subject to the laws and government of Hungary. Its present boundaries and internal divisions and regulations were fixed by Leopold I.; and by the appointment of Maria Theresa it is governed by *bans*, or lords, responsible to a council.

CROCODILE. See Lacerta, under ERPETOLOGY.

CROCUS, SAFFRON, a genus of plants belonging to the Triandria class. See BOTANY.

CROCUS, an old term in chemistry, denoting a metallic salt which has been calcined and reduced to a red or deep yellow colour, as in the case of sulphate of iron, or green vitriol.

CROISADE, the appellation by which the famous expeditions of the Christians against the infidels, for the conquest of the Holy Land, were distinguished. See CRUSADE.

CROIX, ST. one of the Caribbee islands in the West Indies. See CRUZ, SANTA.

CROMARTY, a county of Scotland, occupies a peninsular situation, and is washed on three sides by the Frith of Cromarty and Moray, while it is bounded on the south-west and south by the county of Ross; is about 16 miles in length, and from six to seven miles in breadth. This county was formerly of smaller extent, and was enlarged to its present boundaries about the end of the 17th century. An elevated tract stretches through its whole length, from which a fine declivity extends to the shores of both friths. The rocks chiefly belong to the secondary class; sandstone seems to predominate, and some indications of lead-ore have been observed. The soil along the shore is light, and many agricultural improvements have been successfully introduced; annual additions are made to the extent of the land under culture, and thriving plantations are seen in different parts of the county. The population is between 5000 and 6000; but the returns for the number of inhabitants, as well as all legislative enactments regarding the affairs of local police, include Ross-shire. The whole county is divided into three parishes.

The frith of Cromarty, denominated by Buchanan *Portus Salutis*, the harbour of safety, from the security which it affords, is about 16 miles in length and in some places three in breadth, and is regarded as one of the finest bays in Great Britain. The entrance is between two headlands, called the Sutors of Cromarty, a name, it is supposed, derived from the French words *sur terre*, descriptive of their elevation, and it is about a mile and a half in breadth. The water is of sufficient depth for the largest ships, and the shelter is perfectly secure.

CROMARTY, capital of the county of the same name, stands on a point of land on the Cromarty frith, was formerly a royal burgh, but was disfranchised by an act of the privy council of Scotland on the petition of the inhabitants. The population of the town and parish is between 2000 and 3000; a hemp manufactory, and a brewery on a considerable scale, have been established; the quantity of sackcloth annually sent to London is valued at L.25,000; and pickled pork hams, and dried cod fish, are enumerated among the exports.

CROMLECH is a singular remain of antiquity, which still exists in different parts of Great Britain and Ireland, as well as in some parts of the continent of Europe, and is usually composed of four large stones, three of which of unequal height are perpendicular, and the fourth, a massy slab, is supported by them in an inclined position. The word is supposed to be derived from two words signifying bending or bowing, and stone, alluding to the reverence paid to these structures in some places; or according to others, from the Hebrew word signifying a consecrated stone. Of the uses to which these rude structures were destined, various opinions have been held. While some think that they were designed as altars of sacrifice in the time of the Druids, others suppose that they were intended as sepulchres or monuments

Cromwell. of distinguished persons or of remarkable events, and others still have fancied that they were intended as places for astronomical observation. Borlase's *Antiquities of Cornwall*, Polwhele's *history of Cornwall*, Pennant's *Tour in Wales*, and Grose's *Antiquities of Ireland*.

CROMWELL, Oliver, the celebrated protector of the commonwealth of England, was the son of Robert Cromwell, of a respectable family in the county of Huntingdon, and was born on the 25th of April 1599, in the parish of St John, Huntingdon, in the free school of which he received the earlier part of his education, and was admitted, in 1616, a fellow-commoner of Sidney-college, Cambridge, where he was more distinguished by his expertness and devotion to athletic exercises than to serious study. After two years residence at the university, on his return home the irregularity and licentiousness of his conduct occasioned much uneasiness to his mother, his only surviving parent, who, by the advice of friends, and with the view of correcting his evil habits, placed him at Lincoln's inn, for the purpose of studying the law as a profession. But he now, it is said, abandoned himself to gaming and every kind of debauchery. His marriage with the daughter of Sir James Bouchier, while he was in his 21st year, was the means of checking his licentiousness; and soon after this event he returned to his native place, and lived a regular and sober life. Succeeding to an estate of about L.400 a-year by the death of an uncle, he settled in the isle of Ely, where the property lay, and where it is said he first associated with the Puritans and attached himself to their manners and modes of thinking. He was a member of the third parliament of Charles I., which met in January 1628; on the dissolution of which he retired to the country, and became so deeply involved in the religious controversies of the time, that his own private affairs being neglected fell into embarrassment, and the prohibition against emigration only prevented him from leaving the country, and settling in North America.

In his second election to parliament, Cromwell represented the city of Cambridge, and distinguished himself in that assembly by the warmth and impetuosity of his eloquence, as well as by the carelessness of his dress, and inattention to the neatness of his person. The remonstrance passed in 1641, which has been considered as the cause of the civil war, was strongly supported by Cromwell, and he was now admitted into the councils, and consulted on the plans of the popular leaders, Pym and Hampden. About the commencement of 1642, when the parliament determined to collect an army for the support of their measures, Cromwell raised a troop of horse at Cambridge, and, by the excellent discipline which he introduced, exhibited all the qualities of an experienced officer. In active warfare, his conduct was eminently conspicuous, and particularly at the battles of Marstone-moor, Newberry, and Naseby. Soon after, he acquired great influence with the army, and with their support counteracted the measures of parliament which seemed hostile to his ambitious views. In 1649, he embarked with his army for Ireland, and in less than a year subdued the whole island. The state of affairs in Scotland required his presence in that country, and by an unfortunate movement of the Scottish general he was successful in counteracting the intended invasion of England. In 1651, he gained the battle of Worcester, which he pompously but truly describes as the crowning victory. On the 16th of December 1653, he assumed the supreme authority, and was declared Protector of the Commonwealth; and after a vigorous administration of nearly five years, the events of which belong more to history than to biography, he died on the 3d of September 1658, and while he was in his 66th year. He was succeeded in the protectorate by his son Richard, whose talents and temper were ill fitted to struggle with the difficulties of so conspicuous a station. He therefore resigned his authority, and lived in a private station till his death in 1712.

Of the character of this extraordinary man the following sketch is drawn by Mr Hume: "If we survey the moral character of Cromwell with that indulgence which is due to the blindness and infirmities of the human species, we shall be inclined to load his memory with such violent reproaches as those which his enemies usually throw upon him. Amidst the passions and prejudices of that time, that he should prefer the parliamentary to the royal cause will not appear extraordinary, since even at present many men of sense and knowledge are disposed to think that the question, with regard to the justice of the quarrel, may be regarded as doubtful and ambiguous. The murder of the king, the most atrocious of all his actions, was to him covered under a mighty cloud of republican and fanatical illusions, and it is not impossible but he might believe it, as many others did, the most meritorious action which he could perform. His subsequent usurpation was the effect of necessity as well as of ambition; nor is it easy to see how the various factions could at the time have been restrained without a mixture of military and arbitrary authority. The private deportment of Cromwell, as a son, a husband, a father, a friend, is exposed to no considerable censure, if it does not rather merit praise. And, upon the whole, his character does not appear more extraordinary and more unusual, by the mixture of so much absurdity with so much penetration, than by his tempering such violent ambition and such enraged fanaticism with so much regard to justice and humanity."

CRONENBURG, or Cronberg, a strong fortress on the island of Zealand in Denmark, and at the entrance of the Sound, where the Danes levy a toll on all foreign ships engaged in the Baltic trade.

CRONSTADT, or Kronstadt, a sea-port town of Russia, and the principal naval station, stands on the southern extremity of the island Retusari, in the gulph of Finland; was founded, in 1710, by Peter I. not only for the convenience of its harbour, but also as a bulwark for the defence of Petersburgh. The passage for ships of burden to the metropolis, is through a narrow channel on the south side of the island, one side of which is commanded by Cronstadt and the opposite side by Cronslot and the citadel. Cronslot and the citadel are fortifications constructed of wood on small sandy islands, and Cronstadt itself is defended towards the sea by wooden piers projecting into the water, and by ramparts and bastions on the land side. The houses of the town are chiefly of wood, and are disposed in a straggling irregular manner, excepting the great square, which is adorned with excellent houses of stone. The imperial hospital for sailors is on so large a scale, that 25,000 patients have been admitted in the course of a single year. Three separate harbours are appropriated for the navy and merchant ships. The western harbour, which is destined for the latter, is so spacious as to admit 600 vessels at the same time; the middle harbour receives frigates and sloops of war; and the eastern harbour is intended for ships of the line. Extensive dry docks for building and careening ships of war have been constructed; and a rope-work for large cables, and a foundry for cannon, have been established. The population of Cronstadt, of which the greater proportion is connected with the navy and army, is estimated at 40,000; but among them are found English, Germans, Dutch, and Americans.

CROSIER, a shepherd's crook, and the symbol of pastoral authority, was originally a wooden staff, in form of the letter T, but is generally of gold or silver, crooked at the top, and carried occasionally before bishops and abbots, and held in the hand while solemn benedictions are pronounced. In the Greek church the patriarchs only are permitted to have this badge of authority; and in the Roman Catholic church regular abbots officiate with a mitre and crosier.

CROSS, a mode of punishment in which the criminal was fixed to two pieces of wood crossing each other at right angles, like the letter T, or at an inclined angle, as the letter X, and either by means of nails through the hands and feet, or fastened with cords. This mode of punishment seems to have been common among the Syrians, Egyptians, Persians, Greeks, Romans, and Jews; and it was inflicted on the vilest and greatest criminals, as the most shameful and painful death.

CROSS-TEXTURE, a kind of cloth manufacture, of a very thin and light fabric, composed of linen, cotton, or silk, and usually employed for ornamental purposes. See CLOTH MANUFACTURE.

CROTALARIA, RATTLEWORT, a genus of plants belonging to the Diadelphia class.

CROTALUS, RATTLE-SNAKE, a genus of serpents. See OPHIOLOGY.

CROTCHEY, or CORACHIE, a sea-port town of the province of Sinde, in Persia, stands on a bay which affords good shelter for shipping, and is defended by a fort. The population is estimated at 8000, most of whom are Hindoos, and engaged in commercial concerns. As Crotchey is the chief seaport in the province, the trade was formerly considerable, but has, it is said, been lately on the decline. The surrounding territory, which affords abundance of excellent fruits, is low and flat, and is inundated by the Indus from the beginning of July to the end of August.

CROTON, BASE RICINUS, or TALLOW-TREE, a genus of plants belonging to the Monœcia class.

CROUTE, or SOUR CROUTE, a preparation of cabbage, which is minced small, and placed in layers in a barrel with salt and caraway-seeds. It is then pressed down with a heavy weight, and, after fermentation, is excluded from the air, and preserved for use. This preparation has been found highly beneficial to seamen in long voyages, and particularly in obviating the effects of sea scurvy.

CROYDON, a town of Surrey in England, contains about 6000 inhabitants, is remarkable for a large and handsome church, and at one time for the palace of the archbishop of Canterbury, which is now converted into a cotton manufactory. It is 20 miles from London.

CRUCIANELLA, PETTY MADDER, a genus of plants belonging to the Tetrandria class.

CRUSADE, or CROISADE, was a military expedition undertaken by the Christian powers of Europe, for the purpose of delivering the Holy Land from the dominion of the Turks and Saracens. These expeditions commenced in the year 1096, and they derived their origin from a strong veneration for those places in which the ministration of Jesus Christ was exercised, and the interruption which the pilgrims experienced in visiting and performing their devotions at the holy sepulchre. Peter, known by the name of *the hermit*, a native of France, having made a pilgrimage to Jerusalem, was deeply affected with the dangers to which Christians were exposed, and with the oppression under which the Christians of the East laboured, and formed the bold and seemingly impracticable design of rescuing the Holy Land from those warlike powers which held it in slavery. The scheme was communicated to the Pope; his Holiness called a council, which met at Placentia, and was attended by 4000 ecclesiastics, and 30,000 seculars; and the Pope himself, as well as Peter, having addressed the assembly in the most pathetic manner, drew forth the unanimous approbation of all present, and their declared assent to devote themselves to this holy service. Roused by superstition and enthusiasm, men of all ranks flew to arms, and a cross being affixed to the right shoulder as a badge of distinction to those who engaged in the expedition, the enterprise itself was denominated from the French or Latin, *Croisade*, or *Crusade*. The rage for conquering the Holy Land continued for nearly two centuries, and eight different expeditions were undertaken for that purpose.

The first crusade, commenced in 1096, was conducted by the most celebrated military leaders, succeeded in taking Jerusalem, and appointed Godfrey of Bouillon king. The second crusade, which took place in 1144, was headed by the emperor Conrad III. and Lewis VII. king of France. The third crusade, in the year 1188, immediately followed the fall of Jerusalem, before the victorious arms of Saladin, the sultan of Egypt. Richard I. of England took a part in this expedition. The fourth crusade was undertaken in 1195; but after gaining several battles, and taking many towns, was in the end unsuccessful. The fifth crusade, which was published in 1198, was followed by a similar fate; the sixth, which began in 1228, was not more fortunate; the seventh, in 1249, was likewise unsuccessful, and all those engaged in it perished by the sword or sickness; and the eighth, which began in 1270, likewise failed in the recovery of the Holy Land.

Although the motives which prompted these extraordinary expeditions arose from the most absurd superstition, yet it has been justly remarked that they tended greatly, from the intercourse which the adventurers had with more civilized nations, to introduce learning and refinement among the states of Europe. It has been computed, that more than 2,000,000 of persons perished in the different enterprises. See Gibbon's *Roman History*.

CRUSTACEOUS, a term applied to certain animals, as the crab and lobster, which have a shelly or calcareous covering, but usually of a thinner and softer texture than the coverings of testaceous animals, or the proper shell fish.

CRUZ, SANTA, one of the Caribbee islands in the West Indies, is about 24 miles in length, and nine in breadth; has often changed masters since its first discovery, and has been under the dominion of the Spaniards, the Dutch, the English, and the French; in 1696 it was ceded to the king of Denmark, and in 1801 was taken by the British. Christianstadt is the principal town; and in the town, or its immediate vicinity, there is an English, a Danish, and a Roman catholic church, beside an extensive establishment of Moravians. According to the parliamentary report in 1811, the population of Santa Cruz was composed of 1625 whites, 2000 free persons of colour, and 26,795 slaves; and of the whole number of persons of colour and slaves, more than 28,000 have been actually admitted to baptism, and are recorded as belonging to some church or religious establishment in the island. Santa Cruz has been greatly improved, and many parts of it are well cultivated by the industry of the inhabitants, who, much to their credit and humanity, are represented as being kind and indulgent to their slaves.

CRYPTOGAMIA, from Greek words expressive of the parts of fructification being concealed, is the denomination of the 24th class in the Linnæan system of plants.

CRYSTAL, in its original meaning, denotes *ice*, but was afterwards employed to denote rock-crystal, and is now applied to all bodies which have regular forms; and crystallization is the process by which the particles of a body arrange themselves symmetrically when it passes from the liquid to the solid state. See CHEMISTRY.

CTESIBIUS, a philosopher of Alexandria, who flourished about 120 years before the Christian era, and is said to have invented the pump, and the Clepsydra, or water-clock, for the measurement of time.

CUBA, the largest of the West India islands, is included between the 19th and 23d parallels of north latitude, and the 74th and 85th of west longitude; is 764 miles long, and from 70 to 130 miles broad; and is 130 miles distant from the coast of Florida on the north, 60 from the island of St Domingo on the east, 96 from that of Jamaica on the south, and 168 from the peninsula of Yucatan on the west.

A ridge of mountains, like a back-bone, extends the whole length of the island, and divides it into two parts, both of which are ribbed with lateral shoots, between which again numerous streams descend towards the sea, both on the north and the south side, having good harbours at their mouths, and large savannahs stretching along their banks. Fine gold is found in the channels of these streams, —a clear indication that mines of that metal are embosomed in the bowels of the mountains, which also contain copper and other useful minerals. During the months of July and August, great quantities of rain descend; December and January are subject to storms, and the rest of the year is generally dry and tranquil, but exceedingly hot, unless when fanned with the sea-breeze, which blows from noon till night. The soil is dry and fertile, but more than ninety-nine parts of the hundred are still in their natural state. The upper regions are clothed with forests, among which are cedars, pines, oaks, and many other trees of great beauty and value. The savannahs at the foot of the mountains afford abundance of excellent pastures to innumerable herds of cattle. Sugar, coffee, and cotton, manioc, maize, and mastic, long-pepper, ginger, and tobacco, are among its staple productions. It is said that neither wild beast nor poisonous animal inhabits the island; but that it abounds in birds of many different kinds, and in bees, from which vast quantities of honey and wax are obtained.

Cuba was discovered in 1492 by Columbus, by whom it was first called Juanna, and afterwards Ferdinando; but the original name prevailed over both these new designations. It was circumnavigated by Occampo in 1508, and was brought under the power of Spain by Velasquez in 1511, without the loss of a single man. Its population amounted, in 1804, to 432,000 souls, distributed among its cities, towns, and settlements. In every 100 of these inhabitants are 54 whites, 21 free persons of colour, and 25 slaves. The island is said to contain nine cities, 15 towns, and 26 settlements, but many of them are places of little note. St Jago de Cuba, built on a large bay, near the southern coast, is regarded as the capital. It was once a place of considerable trade, but in this respect it has been supplanted by the Havannah. This city stands on the north-western coast, and is the largest, the strongest, the richest, and, in all respects, the most important on the island. It is built in a semicircular form, is about two miles in circuit, and contains 25,000 inhabitants. It consists of narrow streets, paved occasionally with ironwood, and irregular squares, adorned with magnificent churches and other public buildings. The harbour is spacious and safe; its entrance is so narrow that it admits only one ship at a time; and its capacity so great within, that 1000 ships of the greatest burden may ride in perfect safety. It is strongly defended by the Moro, the Puntal, and other forts and platforms, mounted with a prodigious quantity of artillery; on the land-side it is also well protected by garrisoned forts. Yet this apparently-impregnable place was taken by the British in the year 1762, but was restored to Spain by treaty in the following year. Spanish ships, homeward bound, rendezvous in this harbour. Bayomo, or St Salvador, is a small inland town, with large plantations of tobacco in its neighbourhood. The trade of Cuba, which is considerable, consists in the exportation of its own produce, and in the importation of such European goods as are required by its inhabitants. The whole island is divided into two governments, with their subordinate jurisdictions, of the whole of which the governor of the Havannah is captain-general. The military force in 1804 was 24,511 men. It has been said of this fine island, that it has more churches than farm-houses, more priests than planters, and more lazy bigots than useful labourers.

CUBE a regular geometrical figure, composed of six equal sides.

CUBIT a measure of length, equal to the length of a man's arm from the elbow to the tip of the fingers. The English cubit is equal to 18 inches, the Roman cubit is equal to about $17\frac{1}{2}$ inches, and the cubit of Scripture is nearly equal to 22 inches.

CUCUBALUS, Berry-bearing Chickweed, a genus of plants belonging to the Decandria class.

CUCULUS, the Cuckow, a genus of birds belonging to the order of Picæ. See Ornithology.

CUCUMIS, the Cucumber, a genus of plants belonging to the Monœcia class.

CUCURBITA, the Gourd and Pumpkin, a genus of plants belonging to the Monœcia class.

CUDALORE, a town on the sea coast of the Carnatic, 15 miles from Pondicherry and 100 miles from Madras; is naturally on a strong situation, but has been several times the scene of severe struggles between European powers to obtain its possession, and particularly during the war in 1780, when the inhabitants of the surrounding territory had either perished or emigrated, and left their villages and lands in a state of ruin and desolation. Since that period a pleasing change has taken place, and the improvement of the country has been great and rapid.

CUDWORTH, Ralph, a learned English divine, was born in 1617 at Aller in Somersetshire, where his father was rector. From his early childhood he shewed much aptitude for the acquisition of knowledge, and was admitted into Emmanuel college, Cambridge, before he had completed his thirteenth year, though he was not matriculated till he was in his fifteenth year. In 1637 he took the degree of master of arts, was elected to a fellowship, soon held a high situation as a private tutor, and had the honour, in that capacity, of giving instructions to Sir William Temple and Archbishop Tillotson. This college, not long afterwards, presented him to the rectory of North Cadbury in Somersetshire; and as he was a great master of oriental languages, he was in 1646 appointed regius professor of Hebrew. Having taken the degree of doctor in divinity, he was soon after elected to the mastership of Christ's college, Cambridge—an office in which he spent the remainder of his life, and was one of the divines appointed by a committee of Parliament to revise the translation of the Scriptures. After the restoration of King Charles, he was preferred to the vicarage of Ashwell in Hertfordshire, and was in 1678 installed prebendary of Gloucester. The same year he published his True Intellectual System—a work intended to refute the principles of atheism, and which displays profound erudition, much acuteness of reasoning, a very intimate knowledge of the Platonic philosophy, and some peculiar notions respecting the formative energy of what he calls *Plastic Nature.* He was an author, however, at a much earlier period, by the publication of a *Discourse on the Nature of the Lord's Supper*, and some occasional sermons. He wrote also, treatises on Good and Evil—Liberty and Necessity—on the Creation of the World—and on the Learning of the Jews—a Commentary on Daniel's Seventy Weeks—and an Explanation of Hobbes' notions of the Nature of God, and the Extension of Spirits. He died in 1688.

CUIRASSIERS, cavalry which are armed with cuirasses, a kind of defensive armour made of iron plate, and covering the back and breast. A celebrated regiment of this description belonged to the French army in the time of Buonaparte.

CULEX, the Gnat, a genus of insects belonging to the order of Diptera. See Entomology.

CULLEN, William, an eminent Scottish physician and professor, was born on the 11th of December 1712, in the county of Lanark, probably at or near Hamilton, of which his father had been a magistrate. After receiving the usual education of a country school, he was bound apprentice to a surgeon in Glasgow, where he had an opportunity of pursuing his medical studies with advantage, by attending the lectures in the college. When the term of his apprenticeship had expired, he accepted the situation of surgeon to a West India ship, and made several voyages in that capacity. We next find him settled as a surgeon and apothecary in the small village of Shots, in his native county, where he soon acquired the esteem and patronage of the few genteel families in the neighbourhood, and in consequence of his knowledge of chemistry gained the favour of Archibald, duke of Argyle, who happened to be on a visit at the house of one of Cullen's best patients. But this obscure village was too limited for his superior genius, and he quickly removed to the small town of Hamilton, and entered into partnership with William Hunter, afterwards so celebrated as an anatomist and accoucheur, and for his lectures in those departments of medicine. This copartnery was soon dissolved, in consequence of Hunter's settling in London, but the friendship of these distinguished men subsisted till the death of Dr Hunter. During this coalition Mr Cullen contrived to attend lectures at Edinburgh, where he formed an acquaintance with Dr Clark, a celebrated practical physician, whom he afterwards called in to assist him in curing the duke of Hamilton of a dangerous disorder, and thus secured a friend without lessening his own reputation.

He had nearly completed his 28th year when, in 1740, he obtained the degree of doctor of medicine in the university of Glasgow; and about the same time he married the daughter of a clergyman with a small fortune. In 1746 he was invited to Glasgow to fill the office of lecturer on chemistry, which did not at that time constitute a professor's chair in the college. Chemistry was then beginning to attract more general attention in consequence of the researches of Stahl and Boerhaave, and Cullen contributed not a little to its advancement. Besides his own exertions, he had the honour of being preceptor in this science to Black, whose important discoveries and improvements have been already noticed.

(See BLACK.) Five years after his appointment to the chemical lectureship, he was admitted to a full participation of university privileges, by being nominated regius professor of medicine; but he was again called to take an active part in the advancement of chemistry, by the death of Dr Plummer, professor of that science at Edinburgh, in 1756.

Dr Cullen readily accepted the invitation of the magistrates and town council of Edinburgh to fill the vacant chair; and from that time may be dated the ardour and avidity with which the science of chemistry has been prosecuted by the Edinburgh medical students, and the great emolument which that chair has since produced to the professor. Whether the high reputation of the new professor excited the jealousy of his colleagues, or the free and novel opinions he even then began to promulgate, respecting the theory and practice of medicine, alarmed the zealous disciples of Boerhaave, by whom the medical chairs of Edinburgh were at that time filled, is uncertain; but soon after his establishment in the Scottish capital a coolness took place between him and the other medical professors, and disputes arose between the students on the opinions of their new teacher. But these soon subsided, and the fame and character of Cullen shone brighter than before.

Besides his lectures on chemistry, and the clinical lectures which he gave in his turn, his avocations were, in 1763, increased, by being called on to finish a course of lectures on Materia Medica, which had been interrupted by the death of Dr Alston. In this unexpected and laborious task he acquitted himself so ably, that a copy of his lectures, taken down by one of his pupils, and surreptitiously committed to the press, experienced a rapid sale. In 1764 he was elected an honorary member of the Royal Medical society of Edinburgh, in whose hall his doctrines had for some time formed a prominent object of discussion. Two years after, his labours as a professor were again diversified by the death of Dr Whyte, who held the chair of the theory or institutes of Physic, and whom Dr Cullen was appointed to succeed. In consequence of this nomination, he resigned the Chemical chair to Dr Black, and that of Materia Medica to Dr Francis Home. He continued to lecture on this subject solely till 1769, when by an arrangement with Dr John Gregory, then professor of the practice of Physic, these two celebrated men agreed to lecture alternately on the Theory and Practice, till the death of Dr Gregory in 1773, when Cullen succeeded to the practical chair, which he continued to fill till his death.

During his residence in Edinburgh, Dr Cullen enjoyed a very extensive practice; and yet with all these multifarious employments, he composed and published several valuable text-books, especially his Synopsis of Nosology, first published we believe in 1769, and republished with additions in 1782; First lines of the Practice of Physic, published at first in separate volumes between 1777 and 1783, and completed in 4 vols. in 1784; Treatise of the Materia Medica, intended as an improvement on the imperfect copy of his Lectures which had been printed in 1778, and published in 2 vols. 4to in 1789; and the Institutions of Physiology, containing heads of his Lectures on that subject, and published in 1777. Of these works the first two are still used as text-books at Edinburgh, and are held in deserved estimation elsewhere. Dr Cullen also published a pamphlet on the means of recovering persons drowned and apparently dead; and a volume of Clinical Lectures, taken we believe as notes by one of his pupils, appeared at London a few years after his death.

Between 1780 and 1790, his strength gradually declined, and he was obliged to use a sedan chair in making his visits, and to take a greater quantity of stimulus than usual. He was accustomed latterly to take after dinner a glass of strong rum with a good deal of lump sugar dissolved in it. Towards the end of 1789, he found himself unequal to the labour of the class-room, and resigned the office to the present Dr Gregory. He died in February 1790, at the advanced age of seventy-seven.

Dr Cullen's person was tall and thin, but not elegant; his countenance and particularly his eye expressive; his voice clear and distinct, and his elocution easy and fluent. In manners he was plain but polite and pleasing, cheerful and communicative in conversation, and an agreeable host and companion. As a teacher, he was intelligent, luminous, and perspicuous; as a practitioner, sagacious, attentive, and humane; as a writer, clear and instructive, but in his later publications prolix and garrulous. As his medical doctrines must come under review in a future part of this work, it would be an unnecessary anticipation to speak of them here. They have obtained for their author the title of the leader of a sect in medicine, but improperly, as few of them are peculiar to Dr Cullen.

Cullen was the father of a numerous family, two of whom followed the medical profession and graduated at Edinburgh, but died young; and a third son was brought up to the Scottish bar and attained the situation of a Lord of Session. One of his daughters has also rendered herself conspicuous as an author.

CULM or CULMUS, a term in Botany, signifies the straw or haulm, and is the proper trunk of grasses, which supports the leaves, flower, and seeds. See BOTANY.

CUMBERLAND, the most north-westerly county of England, lying between the latitudes of 54° 6′ and 55° 7′ north, and longitudes 2° 13′, and 3° 3′ west, and bounded on the north by Scotland and the Solway frith, on the east by Northumberland and Durham, on the south by Westmoreland and Lancashire, and on the west by the Irish sea. Its medium length is about 70 miles and its medium breadth 35. In superficial extent it comprises about 1516 square miles, or 970,240 English acres.

General aspect.—The outline of this county presents an irregular four-sided figure, and is less indented with bays and creeks next the sea than most of the western maritime counties. Next the coast the surface is flat, but it rises rapidly towards the interior, where it is extremely mountainous, with intermediate vallies, romantically diversified with lakes and rivers. Few parts of England present more sublime and picturesque objects to the admirer of nature than Cumberland, and none exhibits a greater contrast in its several districts.

Cumberland.

Soil and climate.—The soil upon the coast is in general loamy, or consists of bog or black peat earth, which last prevails most on its eastern border; but much of the county is rocky and barren, and contains extensive wastes, where a stratum of sand and gravel is very thinly covered with vegetable mould. The climate is variable, but in general healthy. In the interior the air is keen and cold, but towards the coast sufficiently temperate, though frequently very damp, from the great quantity of rain which falls on that side of the island. Numerous instances of longevity have occurred.

Mountains.—Two ridges of mountains intersect this county, one on its eastern side, constituting nearly the highest land in England, and distinguished by the names of Crossfell, Hartsidefell, Geltsdale forest, and Spadeadam waste. Of these, Crossfell is about 3390 feet high. The other range occupies the south-western part of the county, and is still higher than the former, Skiddaw, its most elevated point, being estimated at 3500 feet high, and Saddleback 3324. Among these mountains the views are extensive and majestic. Towards the south is the romantic pass of Borrowdale, with a detached rock of considerable height, called Castlecrag, standing at its entrance, and the beautiful vale of Keswick stretching on the north.

Lakes.—The principal lakes of Cumberland are, Derwent water, in the vale of Keswick, with a cataract of 200 feet high; Ulswater, which is only partly situated in this county; Buttermere, Bassenthwaite, and Overwater. There are also several small lakes or *tarns*.

Rivers.—Of the numerous rivers which water Cumberland, the most remarkable is the Eden, which rises in Westmoreland, and, flowing in a northerly direction, falls into the Solway frith about 16 miles below Carlisle. The other rivers are, the Eamont, which joins the Eden, the Derwent, the Duddon, the Archer, the Greata, the Caldew, the Esk, the Liddel, and the Irthing.

It is proposed to construct a canal between Carlisle and the Solway frith, for the purpose of facilitating the conveyance of goods.

Natural history.—As in most mountainous districts, the mineral productions of Cumberland are numerous and valuable. The eastern range contains limestone, sandstone, slate, and lead ore, and the western ridge affords limestone and sandstone, and in both districts there is abundance of excellent coal. The limestone is much in request, and nearly 700,000 bushels are annually exported to Scotland. The slate is of very superior quality, but is almost entirely used in the county. There are about 102 lead mines, which produce annually above 4000 tons. These formerly belonged to the Earl of Derwentcastle, and at his attainder they were granted to Greenwich hospital. Some copper is also found, but not in sufficient quantity to render the working of the mines a profitable pursuit. The coal of this county resembles that of Northumberland and Durham. The principal coalieries are at Whitehaven and Workington, from which ports large quantities are shipped for Ireland, and the neighbouring ports in the west of England. Excellent ironstone is produced here, especially that very rich ore called bloodstone, most of which is sent to the Carron works in Scotland. The finest blacklead, or graphite, is dug from a mine in Borrowdale, which produces every year about L.3000 worth, though a much greater quantity might be obtained were it not esteemed policy to prevent the too frequent working of the mine. Besides these more abundant minerals, there are occasionally found crystals of quartz resembling topazes, fine specimens of jet, and very good marble.

The only mineral springs of any note are those at Gilsland in the vale of Irthing, about eight miles from Newcastle. One of these is a sulphureous water, probably of no great strength; another is a weak chalybeate; and a third is impregnated with alum and vitriol, and appears also to be a chalybeate. The first of these is most frequented.

There is little peculiar in the botany of Cumberland. One of its most abundant vegetable productions is the cranberry, which is gathered in such plenty as to be an object of exportation.

Of a breed of native cattle of a small size with long horns, many are driven into the southern counties, and called by the drovers Cumberland steers. The usual game common in mountainous districts is found here, but in no great abundance. Moor-game is plentiful about Gilsland. Some of the rivers, especially the Derwent, contain salmon; and in the lake of Ulswater fine trout of a very large size, as well as that species of salmon called char, large quantities of which are potted for the London market.

Antiquities.—Among the antiquities of Cumberland may be particularised the Druidical circle, known by the name of *Long Meg and her Daughters*. This consists of numerous unhewn stones, some of which are 16 feet high, and from 12 to 15 in girth, forming all together a circumference of nearly 350 yards. The mother stone is at the distance of 17 yards from the rest, and is 18 feet high. The Picts wall, which belongs partly to this county, was originally constructed by the Roman emperor Adrian, and has been already noticed. See ADRIAN. In the vale of Wanthwaite, at the foot of Saddleback, is a ruinous castle of great antiquity, of which the remains of several towers, with lofty turrets, ragged battlements, and projecting buttresses, are still to be seen.

Population.—Considering its extent, Cumberland is not a very populous county. According to the returns in 1801, it contained 117,230; and according to those of 1811, it included 133,744 persons; so that its increase of population in ten years, appears to have been 16,514. In this number the females predominate.

Divisions.—This county is divided into five districts, called wards, viz. Allerdale above Derwent, Allerdale below Derwent, Cumberland ward, Eskdale, and Leath; and these wards comprehend 104 parishes. Besides the city of Carlisle, the county town, there are 17 market towns, the principal of which are Whitehaven, Cockermouth, Keswick, Workington, Penrith, Wigton, Alston, Brampton, Egremont, Holme, Longtown, and Ravenglass.

Carlisle is pleasantly situated near the confluence

Cumberland. of the Eden with the Caldew, and not more than a quarter of a mile from the Picts wall. It was formerly surrounded by a wall with three gates, the English, Scotch, and Irish gates, pointing respectively to the south, north, and west, but most of the wall has been thrown down and the gates removed. The principal streets diverge from the market-place, and some of them are spacious and contain some good houses, but the market-place is disfigured by a guard-house built during the civil wars. A large and handsome bridge over the Eden, lately built of hewn stone, and near a quarter of a mile long, and several neat public walks, have been recently constructed. Another bridge crosses the Caldew in one of the suburbs, but it is extremely inconvenient. The city, including three suburbs, contains a population of above 12,000 inhabitants. It is adorned by numerous public edifices, of which the castle, the cathedral, and St Cuthbert's church, are most deserving of notice. The castle commands the passage of the Eden, and contains an armoury, in which are usually kept 10,000 stand of arms. This castle is very ancient, being traced as high as the 7th century. In 1568 it formed the prison of Mary, queen of Scots. The cathedral is a venerable structure, partly of Saxon and partly of Gothic architecture, with a choir 137 feet long and 75 feet high, and a large east window, adorned with stained glass. An abbey is attached to the cathedral. In this building Edward I. in 1307, held a parliament. St Cuthbert's church is a recent structure, and, though small, is handsome and convenient. Two workhouses, a grammar school, two charity schools, a school of industry, and a dispensary, constitute the public buildings for charitable purposes and instruction. Carlisle has two markets weekly, on Wednesday and Saturday, besides a cattle market once a fortnight, and four annual fairs for general commerce, and three for cattle. It is a bishop's see, and sends two members to the house of Commons. It is a place of great antiquity, and has been repeatedly occupied, and nearly destroyed, by each of the contending British nations. Here are manufactures of printed goods, hats, and whips. Distance from London 301 miles.

Whitehaven,—stands in a hollow between two hills, on what appears formerly to have been a creek of the Irish sea, and where there is still a bay forming an excellent harbour. It is large and populous, containing nearly 9000 inhabitants, and carries on an extensive trade with Ireland, the western coast of England and Scotland. It has manufactures of ropes and sail-cloth, but its chief trade consists in the produce of its numerous coal mines, some of which are sunk to the depth of 130 fathoms, and extend considerably below the sea. Here is a good dock-yard for ship-building. It is 305 miles N. W. of London.

Cockermouth,—is built at the confluence of the Cocker with the Derwent, having a bridge over the former. The streets are spacious, but irregular. It contains several excellent schools, and a dispensary, and has manufactures of hats, leather, coarse woollen cloths, shalloons, checks, and linens. This town has a population of about 3000, and sends two members to Parliament. Distance from London 305 miles.

Keswick,—is a small, but neat and well-built town, pleasantly situated in a beautiful vale in the neighbourhood of Derwent-water, and near the river Greata, and about 287 miles from London. Cumberland

Workington,—the second sea-port in Cumberland, stands near the mouth of the Derwent, on its south side, and close upon the Irish sea. It is large and populous, has a commodious harbour, and carries on a considerable trade in coal and iron, the produce of the mines in its neighbourhood. There is also a fine salmon fishery. Distance from London 307 miles.

Penrith,—is situated at the foot of a hill near the river Eamont. It is a neat well-built town, with a spacious market place. This place lies on the great road between London and Glasgow.

Wigton,—is situated in what are called the Moors of Cumberland, about 12 miles S. W. of Carlisle, and 304 miles from London.

Alston Moor,—is a small town situated on a hill, below which runs the river Tyne, and over this river it has a stone bridge. It is near this place that the principal lead mines are worked. Distance from London 303 miles.

Brampton,—stands about a mile from the Picts-wall, on the river Irthing, and is a place of some antiquity, although now fallen to decay. It is about 312 miles from London.

Egremont,—stands on a small rivulet near the Irish sea, about 6 miles south of Whitehaven, and about 300 from London. Near it are the remains of an ancient castle.

Holme,—is a small town, standing on an inlet of the sea, about 27 miles from Penrith, and 310 from London.

Longtown,—seated on the Esk near the border of Scotland, and in the high road from London on the west, is 307 miles from London, and 9 miles from Carlisle.

Ravenglass,—is a sea-port, built between the Esk and Irthing. It is new built, has a good road for shipping, and carries on some trade. Distance from London 284 miles.

Husbandry.—Agriculture is not in a very improved state in Cumberland, though more arable land is now cultivated than formerly. The farms, and even the *estates* are in general very small, and let on very short leases. The management of the dairy is well understood, and the butter excellent; muscles form a very common manure.

Manufactures and commerce.—Most of the manufactures are noticed above. Cotton-spinning, the weaving of checks and sailcloth, the making of glass and pottery, and the smelting of iron, are the most material. Paper is manufactured near Deadham. The chief exports are coals, iron, lead, butter, bacon, limestone, and blacklead. A good deal of salmon is sent to London. About 300 vessels are employed in the coasting trade.

Cumberland sends only six members to parliament, two for the county, two for Carlisle, and two for Cockermouth. It gives title to a royal duke. It raises 200 men for the militia, and pays one part of the land tax. This county was inhabited by the Brigantes till the 5th century, after which it became subject to Scotland, till, in 1072, William the Conqueror annexed it to the crown of England.

CUMBERLAND, Richard, a celebrated dramatist, was born in the year 1732 at Cambridge, in the house of his maternal grandfather, Dr Bentley, of critical celebrity, at that time master of Trinity college. In his sixth year he was sent to the school of Bury St Edmund's, then under the mastership of the Rev. Arthur Kinsman, a great man on his own ground, but kind hearted, and hospitable withal, who in his vaunting way boasted to Bentley, that he would make his grandson as good a scholar as himself, on which the Doctor replied, "Pshaw, Arthur, how can that be, when I have forgotten more than thou ever knewest?" The prediction, however, savoured of rashness in another respect; for whatever might be the qualifications and industry of the teacher, from the inveterate idleness and apparent stupidity of the pupil, he fell rapidly, and firmly fixed himself at the very bottom of the school. But while he was thus reposing in all the tranquillity of listless idleness, a well-timed admonition of his master, in the sight and audience of his school-fellows, so deeply penetrated his heart with shame and sorrow, that the contempt which he fancied he saw depicted on the faces of his companions so effectually roused within him the dormant spirit of emulation, that he resolved and kept his purpose to obtain his master's good opinion, and to use his best efforts to excel every rival by whom he might be opposed. Learning now became his delight, he rose in his classes as rapidly as he had formerly fallen, and had no pleasure which he loved so well, as to expound Juvenal from the rostrum to his master's visitors on gala days.

His school vacations were spent at the parsonage of Stanwick, of which his father, the grandson of Dr Cumberland, bishop of Peterborough, was rector. In one of these intervals of scholastic duty, he made his first attempt in English poetry, the subject of which was the dock-yards of Portsmouth, and the races of Winchester. In the evenings he read the choice dramas of Shakespeare to his mother, who by her judicious observations formed his taste and tuned his ear for poetry; and while the sublime conceptions of that prince of poets, with the glowing language in which they are expressed, were familiar in his mind and on his lips, he arranged in one act a drama of his principal characters, which he entitled, *Shakespeare in the shades*.

In his twelfth year he was removed to Westminster where he was associated with many young men, who afterwards rose to distinction, and found in Doctor Nichols a teacher who knew the dead languages and the living manners. He spent two years advantageously at this celebrated seminary, improving himself especially in the composition of Latin verses. The premature death of a beautiful and beloved sister occasioned his removal from Westminster and his admission into Trinity college, Cambridge, at the uncommonly early age of fourteen years. In this new situation he was left, through the infidelity of his tutors, almost wholly to himself in the direction of his studies; but a student in the college of which his revered grandfather had been master, with his works, and the works of some of his other ancestors in his hands, and fired with the ambition of pursuing their career, and of obtaining their fame, his application sustained almost no intermission or relief. While preparing for the public exhibitions of the schools, he restricted himself to six hours sleep, and lived almost entirely on milk; and on the day of trial, though he was opposed by a profound mathematician, he traced him through all his subtility, obtained a complete victory, and received the approbation of the moderator expressed in more complimentary terms than was usual on such occasions. He went successfully through similar exercises four times in the course of the same year, took his first degree, and became conspicuous as a *wrangler*. But his over exertion, accompanied with abstinence and want of recreation, induced a rheumatic fever, which brought him to the brink of the grave. In his convalescence he went along with his father's family to York, where he spent six months in the gaieties of the place, but which he found extremely unsuitable to his recluse habits. He returned to college with the spirit of acquirement, not dead, but lulled asleep by the idle prattle of assemblies, after having been confounded by the stunning shouts of the chace. On his return to these scenes, which accorded more with his inclination, it was intimated to him that he was expected to offer himself that year as a candidate for one of the vacant fellowships; and scarcely had he given his reluctant consent, when he was apprised that he had been appointed secretary to Lord Halifax, president of the board of trade. This was a situation not to his mind; but he accepted of it, and forthwith entered on the performance of its duties, in compliance with the wishes of his friends, who regarded it as an advantageous entrance on a brilliant and profitable political career. His first employment under Lord Halifax was to study the state of the colonies, and to copy private letters to the governors and civil officers who were stationed in them,—avocations which left him much at leisure for the prosecution of his main design of acquitting himself with honour and success at the ensuing examinations at Cambridge; in which, though he underwent the strictest scrutiny, he gave satisfaction, and was rewarded with a fellowship earlier, both in respect of age and standing, than was usual, and by which a senior candidate for ever lost his election.

On resuming his duties of secretaryship in town, he made, in the publication of an elegy, which he had written during some of his college vacations, his first offering to the press. But the public took little interest in his plaintive ditty, and of course it put little profit in the pockets of Dodsley, the publisher. At this period he spent all the time he could spare from his office with his father's family in the country, and dwells, in his Memoirs, with complacency on the recollection of the friendships he had formed, and of a tenderer affection which he indulged, but did not communicate to its object, during these delightful intervals of business; for they were so exquisitely delightful to both parties, that his father, with the view of enjoying more of his son's society, obtained the sanction of the bishop of London to exchange his living of Stanwick for the suburban

Cumberland parish of Fulham. This arrangement put it in his power to be almost a constant inmate of his father's family, where he was made most happy by the reciprocal exercise of the parental, filial, and fraternal affections which prevailed there, without the intervention of a jarring sentiment. Soon after his father's settlement at Fulham, he was introduced, and was quickly intimate with Mr Doddington, afterwards Lord Melcombe. This singular character had a villa in the neighbourhood of Fulham, where he lived in a style of social magnificence, but which, by the rule of contraries, he named La Trappe. About this time Cumberland lost his office under Lord Halifax, in consequence of that nobleman's resignation of the presidency of the board of trade. But not long after he was elected to a lay-fellowship in Trinity college, and also, in 1759, appointed to the sinecure of the crown-agency for the province of Nova Scotia, which brought him L.200 a-year. On this, though in the event of success he would forfeit his fellowship, he was induced to pay his addresses to Miss Ridge, "whom he had long loved for her modest manners and blooming beauty;" the lady listened to his suit, and made him an excellent wife. All this while he pursued his studies with assiduity, and courted the muses with success sufficient to encourage his perseverance. He planned, and partly executed an epic poem on India; he wrote, and was paid in praise, some occasional poems; and he completed, and offered to the stage, but was not successful, a tragedy entitled *The Banishment of Cicero.*

Amid these events, Lord Halifax was nominated lord-lieutenant of Ireland, and was accompanied by Cumberland in the capacity of Ulster secretary; and as the lord-lieutenant had not given his confidence entirely to Mr Hamilton, the principal secretary, he had many duties of a delicate nature to fulfil, which did not properly belong to his office; but in which he acquitted himself to the satisfaction of his employer, who, to reward his fidelity, offered to raise him to the rank of baronet. This was not the reward he expected, and thought the ribbon of knighthood a poor provision for his young and increasing family; and therefore firmly, but respectfully, declined its acceptance. This refusal of rank deprived him of his lordship's patronage; who, after his reception of the seals of secretary of state, repulsed an application of his former secretary, by telling him *he was not fit for every office;* and when he sought, through a different channel, the humble situation of clerk of reports in the office of trade and plantations, because of the restiveness of his legitimate patron he took occasion formally to break with him.

From these political agitations he sought repose in the pursuits of literature, and composed an opera, entitled, *The Summer Tale;* and soon after produced his comedy of *The Brothers,* which was successfully represented in Covent Garden. Next year, while on a visit to his father in Ireland, who, through the interest of Lord Halifax, had been presented to the see of Clonfert, he planned and partly composed his *West Indian.* This popular play was brought on the stage by Garrick, and exhibited to full houses eight-and-twenty successive nights, without the support of an after-piece. His share of profit was a very liberal sum; and the accession to his reputation as an ingenious writer was not less considerable. Cumberland

In his visits to Ireland, which he continued to make annually till his father's death, he had opportunities of drawing his Irish characters from life; and in one of these visits he was presented with the degree of doctor of laws by the university of Dublin; for he had now established his reputation as an author of merit, whose alliance with seminaries of learning, and intimacy with men of eminence, were counted as an honour. Sir Joshua Reynolds, Dr Johnson, Mr Burke, Dr Goldsmith, Mr Garrick, and indeed all who were distinguished for genius and learning, as well as many dignitaries of the church, counsellors of the law, and senators of the state, were now among his familiar acquaintances or warm friends, while he himself was daily adding fresh laurels to his literary wreath by the pruduction of poems, and plays, and pamphlets. One of the latter was a defence of his grandfather, Dr Bentley, from the aspersions of Bishop Lowth, who, in a pamphlet against Warburton, had turned out of his way to call the dead critic *aut caprimulgus aut fossor,* "either a goat-sucker or a ditcher," terms of reproach which his devoted grandson could not suffer to pass without animadversion.

He was still a subaltern in the board of trade when Halifax died, and was succeeded in his office for the colonial department by Lord George Germaine, whom at first he thought cold and ceremonious, but who proved his warm and active friend till his death. He invited him to his house, in which he bade him consider himself at home; on the resignation of Mr Pownall, he was appointed through this generous patron's interest to succeed him as secretary, with the full enjoyment of the place. He had now some political patronage in his own power, and used his influence in procuring Admiral Rodney's nomination to the command of a squadron, which under his auspices captured the Spanish fleet fitted out for the Caraccas.

In the year 1780 he went with his family on a mission to Spain, which had for its object the negociation of a separate peace with that power,—an object which completely failed of success; for though he was distinguished in Spain by many marks of royal favour, and had many interviews with Count Florida Blanca, the Spanish minister, the negociation made no progress; and after a twelvemonth's residence in Madrid, it was finally broken off by his recal to England. This unsuccessful diplomacy involved him in pecuniary difficulties during the rest of his life; for with the exception of L.1000, which he received on his embarkation none of his expences was ever paid, or the reason why they were withheld ever explained.

On his return to England he took up his residence at Tunbridge Wells, where he lived more than twenty years, not free from domestic trials; for he lost his wife, in whom he says he had been "superlatively blest," and was bereaved of some of his children whom he tenderly loved; but he lived in an elegant literary retirement, and in the enjoyment of perfect health. At Tunbridge Wells he composed and published the Observer, first in two, and afterwards in five volumes;

the Anecdotes of Spanish Painters, the materials of which he had collected in that country; Calvary, which he finished in a winter, rising to the work some hours before day; and employed himself in a great variety of other literary labours. In his intervals of leisure he associated with his friends, or cultivated a garden attached to his house; and during the prevalence of the volunteer system he commanded a corps composed of the men of Kent, of whom he speaks with much affection. He lived till he was on the verge of 80 years of age, and died in London after a short illness in 1811, was attended to the grave by a numerous retinue of the genius and rank of his country, and his body deposited near to the sleeping dust of Dryden and Addison.

The productions of Cumberland's pen are various and voluminous: He composed more than fifty pieces for the stage, about forty of which have been published: He wrote a number of short occasional poems, some of which are preserved among his works, and others of which did their office and are forgotten: Besides Calvary, he wrote also, in conjunction with Sir James Bland Burges, another heroic poem, entitled the Exodiad: He wrote several sermons, reasons for believing the evidence of the Christian Revelation, and rendered some of the psalms of David into English metre: He is the author of three novels,—Arundel, Henry, and John de Lancaster: He composed memoirs of his own life, and the preface and several articles in Tipper's Review. He tells us he could compose with equal facility at any time of the day, even immediately after dinner; and was not fastidious as to the place in which he gave birth to the offspring of his brain: His West Indian was written in an unfurnished closet, whose only window looked straight upon a turf stack; and his essays of the Observer in his parlour surrounded by his wife and family. He had rather more than a sufficient share of vanity, of which his impatience of criticism, and the apologies for speaking of himself, which too often interrupt the narrative of his memoirs, are obvious proofs; but the warm and pure affection which he cherished towards all his kindred, and the benevolence of heart which characterized his conduct toward his fellow men in general, are truly edifying, and justify the high compliment which Dr Goldsmith paid him in his Retaliation.

CUMINUM, Cumin, a genus of plants belonging to the Pentandria class.

CUNILA, a genus of plants belonging to the Decandria class.

CUNONIA, a genus of plants belonging to the Decandria class.

CUPAR, the capital of the county of Fife, in Scotland, stands on the banks of the river Eden, contains about 4000 inhabitants, and has manufactures of linen, leather, candles, and ropes.

CUPAR-ANGUS, so called to distinguish it from the preceding, is a town of Angus or Forfarshire, which contains more than 2000 inhabitants, has manufactures of coarse linen, and the vicinity still exhibits the remains of a Roman station, and near the same spot an abbey was erected in the 12th century, few traces of which are now visible.

CUPEL, a small vessel made of bone ashes, and employed for refining gold or silver, and the process is called cupellation. See Chemistry.

CUPRESSUS, the Cypress Tree, a genus of plants belonging to the Monœcia class.

CURACAO, or Curassou, an island in the Caribbean sea, about 24 leagues off the coast of Caraccas, 30 miles long, and 12 broad; situated in the 12° of north latitude, and the 69° of west longitude; and at present in the possession of the Dutch. Its eastern part rises into a hilly elevation, but elsewhere it is low, and nearly level; it is not traversed by streams, but the bays and indentations of the sea form a variety of good harbours. The island is not remarkable for its fertility, and, except in the rainy season, when the thin layer of vegetable mould imposed on the rock which forms the substratum is supplied with moisture, it presents but a parched and sterile aspect. Tolerable crops, however, of sugar, cotton, tobacco, and fruit are raised in it annually, and large flocks and herds are fed in its pastures.

The town of the same name is large and beautiful, both in respect of situation and architecture; it has a good port, is defended by a castle, and contains excellent warehouses. Curaçao was once the seat of an extensive contraband trade with Spanish America. The goods were shipped at Portobello and Carthagena, and exchanged in the ports of the island for the manufactures of Europe and the East Indies, with which it was plentifully supplied. In 1810 it exported goods to the amount L.263,996, and imported others to the amount of L.236,181. Its inhabitants, especially in the towns of Curaçao and Williamstadt, which is considered as the chief on the island, are a mixture of most of the nations of Europe, Jews, Negroes, Indians, and half-casts. The population is stated at nearly 13,000, of which about 3000 are whites, 6000 are negro slaves, and the rest free blacks and persons of colour.

The Spaniards took possession of this island in 1527, and in 1634 they were driven from it by the Dutch. In 1798 it was captured by the British, but restored to the Dutch at the peace of Amiens 1801. The British again captured it in 1806, and kept possession of it till the pacification of Europe in 1814, when it was once more given up to the Dutch.

CURATELLA, a genus of plants belonging to the Polyandria class.

CURCULIO, the Beetle, a genus of insects belonging to the order of Coleoptera. See Entomology.

CURCUMA, Turmeric, a genus of plants belonging to the Monandria class, and of which the root of one species is well known as a dye-stuff.

CURDISTAN, a province of Turkey in Asia, is situated between the 33° and 88° of north latitude, and the 47° of east longitude; and is bounded by the Tigris on the west, Turcomania on the north, Persia on the east, and Irack Arabia on the south.

Physical state.—These limits are very extensive, and include the greater part of ancient Assyria proper. The northern and eastern districts are mountainous, exhibiting in some places stupendous chains, and groups of rugged precipitous summits; and in other places expansive table lands, covered with herbage and stunted trees; the intervening vallies, as well as the great plains on the Tigris, and some of its larger tributary streams, present at different points of view a great variety of picturesque scenery. All the streams which traverse the region flow towards the Tigris, in which at last they lose themselves. The most considerable of them are the Great and Little Zab, the Diala, and the Odorneh. The sides and the summits of the upper districts are covered with straggling coppice wood; the lower hills are shaded with forests of the finest oak; the steppes, or the upland plains, produce excellent pasture for innumerable flocks and herds; and the sheltered vallies and alluvial plains yield, or rather might easily be made to yield, exuberant harvests of wheat and rice, cotton and silk, wine and oil, sugar-cane and tobacco, and fruits of the finest flavour. Neither the botany nor the zoology of the region has been investigated; but it may be safely inferred that it is rich in both. Many a flower must there be born to blush unseen; and many rare animals must there scour the plains, or haunt the forests and the recesses of the mountains.

Social state.—The Curds who inhabit this part of Asia are of Tartar origin, and are divided into hordes that wander from place to place without any certain habitation, and those tribes that have fixed residence in the towns and villages of the country. The former race have extended themselves beyond the limits of the country which bears their name, and are to be found in various parts of Asia Minor and Syria. They lead a strictly pastoral life, feeding their flocks and dwelling in tents, which in summer they pitch in the upland districts, and in which they both eat and sleep on mats; and the pieces of which, when they are struck, are made up in bundles and laid, with their furniture, on the backs of horses or oxen, and carried where their owners list. The men tend their cattle, engage in the chase, or go in bands in quest of plunder. Their horses, in which they delight, are large, beautiful, and active. The women stay at home to superintend the nursery, the dairy, and the kitchen. The children go next to naked in the coldest weather, and grow up in absolute ignorance except the savage customs of their parents which they learn by imitation. The inhabitants of the towns are people of more settled habits, and employ themselves in the cultivation of the soil, and in manufactures and commerce. The vicinity of the towns and villages only is cultivated, where the fields are interspersed with gardens, and where the grain grows so rank that when it is about six or seven inches long it is pastured with cattle. The principal towns are, Kerkook, seated on an eminence in a hilly country, with a population, as it is said, of 18000 souls, and containing several churches and mosques, and a great mass of mean houses, divided by narrow dirty streets; Solymania a Shehr e Zour, with 6000 inhabitants, situated in a delightful country at the foot of a mountain; Erbille, supposed to be the ancient Abela, where Alexander triumphed over Darius, a town containing about 3000 souls; Shahr e Van, the ancient Apollonia, with a population of 4000; Senna, in the province of Ardelan, surrounded by orchards, inhabited by 6000 Curds, and frequented by merchants from various places; and some others of less note. The inhabitants of these towns manufacture Turkey-leather, and have a considerable commerce in timber, gall-nuts, oil, dried fruits, and grain.

These people enjoy a kind of rude independence of foreign powers, paying little regard to the authority either of Turkey or Persia, but obedient to their own chiefs, who exercise over them a kind of patriarchal power. According to Volney, they differ from their neighbours, the Turkmans, in some particular customs. The Turkmans give a dowry with their daughters,—the Curds receive a premium for them. The Turkmans have no respect for antiquity of extraction,—the Curds value it above every other possession. The Turkmans do not steal,—the Curds are plunderers by profession. As to religion they are reputed Mahometans, but give themselves little trouble about its opinions and rites; many of them are also nominally Christians and some traces of Zoroaster's doctrine of a good and evil principle may still be traced among a sect called Yardia. The Persian alphabet is in use, but the language is a mixture of Persian, Arabic, and Chaldean dialects.

CURFEW, or CURFEU, from the French, signifying to *cover fire*, was originally a signal given to the inhabitants of cities that were taken in war, to shut their houses and retire to rest, that they might be in some measure secured from the insults and depredations of the troops of the conqueror. The curfew bell was also a signal for the inhabitants of cities to extinguish their fires. William the Conqueror appointed, under severe penalties, that all persons should put out their lights and fires at the ringing of a bell at eight o'clock in the evening; and hence the practice has continued to the present day, and in England is still known by the name of the curfew-bell. This precaution was highly necessary in early times, from the nature of the houses and the situation of the fireplaces in them. But, besides securing houses against accidents by fire, the same law, which was very generally established in Europe, for extinguishing or covering fires, was meant also, it is supposed, to check the turbulence which often prevailed in the middle ages, by forcing the people to retire to rest, or at least to keep within doors.

CURRIE, JAMES, celebrated as a physician and a writer, was a native of Scotland, and born in Annandale, a district of Dumfries-shire, in 1756. His father was minister of the parish of Middlebie; and at the parochial school of that place young Currie commenced his education. When 13 years of age he was placed at the grammar-school of Dumfries, then taught by Dr Chapman, in whose house he boarded. It is probable that he was originally intended for the church, but having accompanied his father on a visit to Glasgow, the busy scenes he witnessed gave him a predilection for a more active life, and his father was induced to send him as a mercantile clerk to Virginia. He was then in his 15th year, and he remained abroad till he was 20. During his residence in America, the disputes took place between the colonies and the British government, and Currie espoused the cause of the latter, and published in a provincial newspaper several able letters against

Currie. the patriots. These papers rendered him unpopular in America; and finding his situation in other respects unpleasant, and having about this time lost his father, he determined, with the advice of his relation, Dr Currie of Richmond, in Virginia, to return to Britain and commence the study of medicine, proposing, when the troubles should have ceased, to go back and settle at Richmond as a physician. He accordingly embarked for his native land by way of the West Indies, and arrived at London in 1776, after having suffered many dangers, and nearly suffered shipwreck in his passage.

He entered on his course of medical studies at Edinburgh, in the session of 1777-8, and continued it with great diligence and success till the spring of 1780. In 1778 he became a member of the Medical society, in which he soon distinguished himself as an elegant writer and good speaker. In his second session he wrote and defended in this society a paper "On the Influence of Cold on the Living Body," which laid the foundation of an excellent treatise to be presently noticed. In 1780 he endeavoured to procure an appointment in the army medical staff; and, as preparatory to this, accepted the commission of ensign and assistant-surgeon in the regiment commanded by Sir William Erskine. With the view to qualify himself for a staff appointment in Jamaica, he obtained a diploma from Glasgow, as the early sailing of the fleet for the West Indies did not permit him to wait till the stated period for conferring degrees in the university of Edinburgh. But Dr Currie, though backed by the interest of Sir John Pringle, failed in obtaining the situation he desired; and, after passing the summer at London, he, in the autumn of 1780, settled at Liverpool, where a favourable opening presented, in consequence of Dr Dobson removing to Bath. Though so young a physician, he gradually acquired a considerable practice, and, from his literary talents and pleasing manners, became intimate with most of the eminent men then residing at or near Liverpool, and with them formed a literary club.

In 1783 he married Miss Wallace, daughter of an Irish merchant, and a descendant of the Scottish hero of that name. His prospects were now in the highest degree flattering; but they were nearly blasted in the following year, by an alarming illness which seized him, in consequence of severe fatigue and anxiety which he underwent in attending the last illness of his friend Dr Bell of Manchester. Though he gradually recovered from this disease, it had a serious effect on his constitution, and eventually shortened his life. In the mean time his practice and his celebrity increased; in 1790 he was elected member of the Medical society of London, and in 1792 member of the Royal society. About this time he employed himself with great activity in promoting the institution of a lunatic asylum at Liverpool, and became one of the attending physicians.

In 1797 he gave to the world his best and most useful publication, "Medical Reports on the effects of Water," &c. containing the result of eighteen years observation and experience of his own, besides numerous facts and remarks communicated by others, among whom Dr William Wright of Edinburgh holds a conspicuous place, on the external and internal use of water in preventing and curing disease. This work has been very generally read and admired, and in 1804 was republished with two large additions, so as to form 2 vols. 8vo. Its effect has been to extend the practice of applying cold water to the body in febrile and some spasmodic diseases; to prove that it may be employed with advantage in cases, such as scarlet fever in its first stage, where it had been supposed inadmissible; and that where it does harm, it is owing to its being used in such states of the body as prevent the necessary and healthy re-action of the system.

Towards 1804, Dr Currie's health began rapidly to decline, and in the summer of that year he found it necessary to seek for relaxation and change of air in his native country. This visit recruited his spirits, and apparently improved his health, so that he returned to Liverpool, but found himself again compelled to change the scene. He now repaired to Bath, where, had his strength permitted, he might have gained an extensive practice, but he soon became incapable of all active exertion, and died at Sidmouth in March 1806, in the fiftieth year of his age.

Dr Currie's endowments, both of person and mind, were such as to procure favour and command respect. His figure was tall and graceful, his countenance expressive and intelligent, his manners engaging and polite. His professional talents were of the first class, and, aided by diligent study, acute observation, and strict attention to his patients, were eminently successful.

It was not merely in his professional works that Currie's abilities as an author were displayed. Besides the letters in the American papers already noticed, he is said to have been the writer of a celebrated political pamphlet—a Letter from Jasper Wilson to Mr Pitt, at the commencement of the revolutionary war, reflecting on the conduct of ministers. He has also rendered himself eminently conspicuous as a biographer, by his life of Dr Bell, inserted in the first volume of the Memoirs of the Manchester Philosophical and Literary Society; and more especially by the life of Burns, prefixed to his edition of the works of that unfortunate bard, published in 1800; a work which reflects the highest credit on the editor for his abilities as a writer, and his feelings as a man.

Cusco. CUSCO, a city of Peru in South America, and the capital of the empire of the Incas, is supposed to have been founded about the 12th or 13th century. Cusco is an episcopal city, and the cathedral is a magnificent structure of stone; beside which, numerous churches, religious houses, and hospitals have been erected. The houses are generally built of stone, and are furnished with spacious apartments, some of which are richly decorated. The population has been stated sometimes at 50,000, and sometimes at 26,000, of which three-fourths are native Indians, who are chiefly employed in the manufacture of cotton cloth and coarse linen; and the sugar and other natural productions of the soil in the surrounding territory, furnish the materials of commerce. When the Spaniards entered Cusco and took possession of it in 1534, they were struck with the splendour and magnificence of the city, and particularly of the palace of the Incas and the temple of the sun. Cusco is 500 miles eastward from Lima.

CUSCUTA, DODDER, a genus of plants belonging to the Tetrandria class, and of which *Cuscuta Europea* is a parasitical plant, and attaches itself to furze and some other plants.

CUSTRIN or KUSTRIN, a fortified town of Brandenburg in Prussia, stands in the middle of a morass at the confluence of the Warther and the Oder, and communicates with the surrounding country by means of causeways; the number of houses within the walls is said not to exceed 200, among which are several churches, magazines, arsenals, and hospitals. The suburbs are of considerable extent, and the inhabitants are chiefly employed in the labours of agriculture. The lakes and marshes in the vicinity abound with fish, great quantities of which are salted for exportation.

CYANOMETER, from two Greek words, signifying *blue and measure*, is an instrument invented by Saussure, for estimating the intensity of the blue colour of the sky. See METEOROLOGY.

CYCAS, a genus of plants belonging to the order of palms, the pith of some species of which furnishes the nutritious substance *sago*.

CYCLAMEN, SOW-BREAD, a genus of plants belonging to the Pentandria class.

CYCLE, a term in chronology, denoting a certain period or series of numbers which regularly proceed from the first to the last, and then return again to the first, with a perpetual circulation; as the *cycle of indiction*, a series of 15 years, which commenced from the third year before Christ, and hence if three be added to any given year of the Christian era, and the sum be divided by 15, the remainder is the year of the indiction; the cycle of the moon, or the golden number, which is a period of 19 years, and which being completed, the new moons and full moons return on the same days of the month; and the cycle of the sun, a period of 28 years, which being elapsed, the dominical or Sunday letters proceed in the same order, according to the Julian kalendar.

CYCLOPTERUS, the SUCKER, a genus belonging to the cartilaginous order of fishes. See ICHTHYOLOGY.

CYDER a fermented liquor, prepared from the juice of apples. See BREWING.

CYNANCHUM, BASTARD-DOGSBANE, a genus of plants belonging to the Pentandria class.

CYNARA, the ARTICHOKE, a genus of plants belonging to the Syngenesia class. For the culture of the artichoke, see GARDENING.

CYNOGLOSSUM, HOUND'S-TONGUE, a genus of plants belonging to the Pentandria class.

CYNOSURUS, DOG'S-TAIL GRASS, a genus of plants belonging to the Triandria class.

CYPERUS, a genus of plants belonging to the Triandria class.

CYPRÆA, COWRY, a genus of shells belonging to the order of Univalves. See CONCHOLOGY.

CYPRINUS, a genus of fishes belonging to the order Abdominales.—See ICHTHYOLOGY.

CYPRIPEDIUM, LADY'S-SLIPPER, a genus of plants belonging to the Gynandria class.

CYPRUS, an island in the Mediterranean sea, subject to the Ottoman Porte, is situated under the 35° of north latitude, and the 33° of east longitude, at nearly an equal distance from the coast of Caramania on the north, and that of Syria on the east, and is about 170 miles in length, and from 30 to 70 in breadth, exhibiting an unequal sided triangle, with the apex toward the east.

Physical state.—A chain of rocky mountains extends along the interior of the island, throughout the whole of its length from east to west. Olympus, St Croix, and Baffavent are the highest points of the chain, and at intervals lateral ridges branch off, and are prolonged to the sea-shore, some of which jut out, forming bold and precipitous promontories. The southern shore bears a striking resemblance to that of the Crimea, presenting a narrow border of fertile land to the eye, washed by the sea on one side, and fenced by steep cliffs on the other. Many spacious plains intervene between the mountains, of which Messarea is the most extensive, expanding, as it is said, 70 miles by 20. The island can boast of no streams that deserve the name of rivers; in the rainy season innumerable torrents rush from the mountains in water-worn channels, which in fair weather exhibit the appearance of unsightly gullies.

On the southern shores the heat is said to be so excessive, that, during the triumph of the sun, all out-of-doors labour is suspended, and animals of every kind, except the lizard and the camel, seek the shade, and repose under covert; sudden squalls of hot wind, too, like the blasts of a fiery furnace, blow occasionally from all points of the compass, but a regular land breeze fans the atmosphere with refreshing influence. Olympus, in some seasons, retains its snow till mid-summer, and the temperature of the northern side of the country is generally moderate, and in consequence of winds from the continent, it is sometimes disagreeably low. Droughts are often prolonged to an uncommon length, and indeed rain is extremely rare in summer. Showers begin to fall in October, and may be expected till the commencement of May, and copious dews refresh the herbage for the next two months; but as the season advances the heavens become as brass and the earth as iron, when the white glare of the ground is apt to induce blindness, and he who incautiously exposes his head uncovered to the heat, runs the risk of being *sun-struck*, or of catching a tertian or a quartan fever.

The gold, the silver, the iron, the tin, and still more the copper, of which the ancient authors, especially Pliny, speak, are not now to be found, or rather a thriftless despotism permits them not to be sought; but the mountains contain extensive beds of marble, and the hills in the neighbourhood of Larnica consist wholly of talc, of which plaster is composed; and the kindred mineral amianthus, of a very superior quality, is found near Baffa, as flexible as silk, perfectly white, fine, and delicately fibrous, and called *cotton-stone* by the natives; in the same vicinity a very transparent species of crystallized quartz occurs, known in commerce by the name of the Baffa diamond; and besides these more common minerals, fragments of jasper, of emerald, amethyst, opal, and agate, are occasionally picked up in the water-courses. The native plants of the island are very various; a fine verdure covers the sloping sides of the hills and the mountain vallies, especially in spring, when the expansive fields of thyme and sweet marjoram, intermingled with the hyacinth, the anemone, the ranunculus, the polyanthus, and the narcissus, in all their variety of kinds, in all their exuberance of beauty, and embalming the breeze with their exquisite perfumes, seem to justify the poets in making it the abode of pleasure and the birth-place of love. Trees are comparatively scarce, and the variety of fruits is not great; but the oranges and apricots are excellent, and the grapes are altogether unrivalled; olive trees and other oil-plants are common; the carob, or St John's bread-tree, cotton shrubs, which yield the finest wool in the Levant, cucumbers, gourds, and melons, are objects of culture; and wheat, barley, and all kinds of pulse, thrive well in the plains. Among the quadrupeds are horses, good for the road, but improper for the chase; asses and mules, reckoned the best in the Levant; camels, and lean small-sized oxen; sheep and goats in large flocks, greyhounds of great swiftness, and foxes and hares, to give scope to their propensity for pursuit. Water-fowls are not numerous, but rails, partridges, snipes, quails, thrushes, and ortolans are abundant; and in the months of July and August thousands of vultures, in their passage to some other country, make this island a resting place. Poisonous animals are more various and numerous than is pleasant or safe. The bite of what is called the *deaf-snake*, though the natives drive it off with bells, is said to be mortal; the hideous and dangerous tarantula is very common; a thin flat animal, about a foot long, of a yellow colour, and furnished with a multitude of legs, which it moves like oars, and from which it is called the *galley*, is said to inflict an incurable wound; and in some seasons swarms of locusts prey upon the herbage of the fields, and render them barren wastes.

Social state.—The oppressions of despotism have diminished the population to something less than 60,000 souls,—a mere handful in comparison of what it once was, and what, when the extent and fertility of the island is considered, it ought still to be. The natives are tall in their stature, stately in their manners, and delight in a splendid dress and costly ornaments. The costume is the same as in the Grecian islands; but the Cyprian taste affects a closer habit than that worn by the Turks. The women have the Grecian features in great perfection, and remarkably fine eyes; they are well skilled in all the cosmetic arts, and can dye the hoariest hair and eyebrows a black or a brown colour. They wear a dress of silk, but are not strait-laced, as they delight in a bulky appearance. Their head-dress is a kind of helmet, towering a foot and a half in height, and composed of an assemblage of printed handkerchiefs, tastefully arranged, under which the hair descends behind in a number of straight braids, and is disposed in ringlets on the face, fastened with sprigs of jasmine. Upper robes of scarlet, crimson, or green silk, embroidered with gold, are common; scarle pantaloons, fastened above the ancle, yellow boots and slippers of the same, with chains of gold around the neck, and bracelets of pearls or precious stones around the wrists, complete the labours of the toilette. The tendency of the climate to induce fevers, prevents the Cypriots from indulging in the use of animal food, except the muscular parts, boiled to a jelly; they also abstain, in hot weather, from eggs, cream, and pastry; but they indulge freely in the use of cucumbers, melons, and other fruits.

The culture of the vine is the principal object of rural economy; and the wines of Cyprus are in very high repute. The vines in the district distinguished by the name of Commanderia, on the southern coast, are reckoned the richest in the island. They are planted in rows during the showery weather of November, pruned in February, and are seldom suffered to rise above three feet in height, and are never trained to trees or sustained by props. The grapes are gathered into baskets made of reeds, are laid on covered terraces, and afterwards squeezed under small presses. The wine is very strong, and requires to be long kept. The Muscadine wine of Limasol, in the vicinity of ancient Paphos, is regarded as the finest of the kind in the island. Much of the wine is put clandestinely under ground to rescue it from the rapacity of the public officers; and always on the birth of a child, a cask of wine, destined to celebrate its marriage-festival, is buried. Mulberries for the food of the silk-worms, the cotton which yields the excellent wool, all the fruit-trees of the island, and even the grain and the garden-stuffs, are raised with little aid from the hand of culture; and indeed many districts are abandoned to the spontaneous operations of nature. The primeval handmill is still to be seen in the country, used as in ancient times by the women. They have, like the inhabitants of the Crimea, a method of keeping bees, which might be imitated with advantage; to this end they build up a wall, formed entirely of earthen cylinders, three feet in length, placed one above another horizontally, and closed at the extremity with mortar. This wall is covered with a shed, and upwards of a hundred swarms are maintained within a very small compass.

The towns, like every thing else, are already in ruins, or are going fast into decay. Nicotia, the capital, is situated in a fine plain, towards the centre of the island, surrounded on all sides by mountains and hills, at the distance of ten miles. The fortifications (though now they are suffered to dilapidate) surpass, in extent and beauty, those of almost every other city. The moat is half a mile wide, and terminates beneath the walls in a deep ditch. The ramparts are still mounted with a few pieces of artillery, and command a fine view of the surrounding country, studded with hamlets and villages, and diversified with various and luxuriant vegetation. The church of St Sophia, a Gothic structure, in which the kings of Cyprus were crowned, and which is now a mosque, is the finest edifice in the city. The church of St Nicholas is at present the *Besisten*,—a hall in which all kinds of provisions are sold, and where the Turkish, the Greek, and the Armenian merchants assemble to transact business. The bazaar, or market, is well supplied with all kinds of merchandize. From the time of Constantine, to the year 1567, the city was nine miles in circuit; at that time the Venetians reduced it to three, and fortified it with eleven bastions and three gates; all the rest they razed to the foundation, demolishing temples, palaces, and the most beautiful monuments. In 1570 it was invested by the Turks, and taken by a general assault, after a siege of 45 days. Many ruins are still to be seen, and plantations of olives, almonds, lemons, oranges, and mulberries, are interspersed among the houses. The most of the houses are mere huts, forming a striking contrast with the superb structures in their vicinity.

Famagusta, situated on the eastern coast, is two miles in circumference; the walls are thick, strongly built, flat on the top, surrounded by a ditch cut out of the solid rock, and flanked by immense towers. It has two draw bridges, one towards the land side, and the other towards the sea, and conducting to the harbour, which is narrow, and shut every evening by a chain fixed to the end of the pier.

The Abbe Mariti found its inhabitants scarcely 200 in number, and all things hastening to destruction.

Salines stands at the head of a fine harbour on the southern shore. The citadel is full of fissures; and the green plants with which it is mantled, contrast finely with the brown and sombre hue of the walls. The bazaar is well supplied, and large warehouses are built by the merchants for the reception of the produce of the island and of foreign commodities. The citadel is garrisoned, and is furnished with a few guns, for no other use, as it would seem, but to salute the ships that come to water in the roads. The town has several churches and mosques, and also a public bath.

Larnica, a modern city, the seat of the Greek bishop, and the storehouse of the insular produce, is situated a mile and a half from Salines, and is built in a semicircular form, with the extremities toward the south. The Greeks have three churches; and the mosque which was once a Latin church, and several other public edifices give an air of magnificence to the town.

Cerina, the ancient *Ceraunia*, is a small place, but distinguished by its citadel built on a large rock near the sea shore. It is in good repair and commands the harbour, from which there is a regular ferry to the coast of Caramania.

Limasol, once a town of some note, is now a wretched place, but has a commodious harbour; and *Baffa*, the ancient *Paphos*, is distinguished only by its splendid ruins and a few paltry houses.

Time has long ago swept away every vestige of the cities once so famous, so that the place which they occupied is unknown. Neither the site of Salamis, the birthplace of Aristus the philosopher, nor Citium, where Cimon died, has been satisfactorily determined. Cytherea, consecrated to the goddess of love and beauty, and Paphos, which contained the most splendid of her temples, and Idalium, when she sought repose, are forgotten or in ruins.

The only manufacture carried on by the Cypriots to any extent is that of Turkey leather, which is made of an excellent quality in Nicotia, and in some of the other towns. The commerce of the island is considerable, and consists of exports of silk, cotton-wool, wines, fruits, madder, turpentine, green earth, brown umber, carob-beans, salt, tar, pitch, and planks. From Caramania are brought for exportation liquid storax, a species of gum, camels hair, yellow wax, gall-nuts, and a few other sorts of goods, all of which, as well as the products of the island, are subject to heavy imposts, and must be paid in ready money, or by bills drawn on houses in Constantinople. The imports consist chiefly of European manufactures, tea, and spices.

The governor has his residence in Nicotia, and his court is composed of a treasurer, a secretary, guards, and a number of inferior officers. Every one is absolute over his inferiors, and is generally a downright tyrant to the utmost limit of his power. Taxes are heavy, and are entirely arbitrary. Mariti tells us that all the Greeks of the name of George are obliged to pay an extra tax. There should be three thousand *Spahis*, and eight thousand Janissaries in the island; there are, however, not more than a hundred of the one, and two thousand of the other; but the pay is always the same, and is pocketed by the commanders.

Moral and religious state.—This island has always been celebrated as the residence of love; and it is said its inhabitants are still his humble votaries; but it is also said to be a physical, and not a moral influence which is exerted over them,—a want which they desire to gratify, and not a sentiment which they delight to indulge. Despotism generates suspicious fear, whence spring cunning and knavery, vices of which the Cypriots are accused, and of which it may be presumed they are guilty. Gold is the universal agent, with which even the blood of the citizens is bought, and criminals of every degree of enormity may commute the award of the law into a fine of money. The criminal code is contained in the Koran, which every judge interprets in his own way; but every sentence which is passed is subject to revision, and no life can be taken away without the consent of the Mullah, the chief ecclesiastic, and supreme judge.

Religion of every name and form is tolerated, and is much diversified. The Turks are numerous, and have their Mullah at their head; the Greeks are still more numerous, and are governed by an archbishop and three bishops; the Marionites have a high priest, and the Catholics have two rectors; Jews also and Armenians are free to exercise their respective rites.

Historical notices.—The Phœnicians are said to have colonized and cultivated this island at an early period. It was divided into nine kingdoms, tributary at first to Egypt and afterwards to Persia, from which it came under the power of Greece, and was afterwards captured by the Romans. In the time of the crusades, it was subject to Richard king of England, who sold it to the Templars, but they, fearing their inability to retain possession of it, delivered it back to Richard, who renounced it in favour of Guy de Lusignan, by whom and by his family it was governed till it was made over to the republic of Venice in 1480; and from that power in the year 1570 it was taken by the Turks, under whose domination it still continues.

CYRENAICS, a sect of ancient philosophers whose founder was Aristippus of Cyrene, a disciple of Socrates, and who held that the supreme good of man in this life is pleasure, by which is meant an assemblage of all the enjoyments of mind and sense. This sect is frequently alluded to by Cicero.—See ARISTIPPUS.

CYTHERA, the ancient name of Cerigo, an island in the Mediterranean which was sacred to Venus, and hence Cytherea is one of the names of Venus.

CYTISUS, TREE TREFOIL, a genus of plants belonging to the Diadelphia class.

CZAR, a title assumed by the sovereigns of Russia, and supposed by some to be derived from *Cæsar*, the appellation of the Roman emperors. But the word signifies *king* in the Sclavonian language; and it was applied by Maximilian I. emperor of Germany, to Vassili Ivanovitch in the year 1514. The title of Emperor was originally assumed by Peter the Great, and acknowledged by most of the European courts about the year 1722.

D.

D, which is the fourth letter of the alphabet, and the third consonant, is generally arranged with the lingual letters. It holds the same place in the alphabet of most ancient languages; the form, which is the same with that of the Latins, seems obviously to be derived from the corresponding letter of the Greeks. The letter D is a numeral, denoting 500, and with a line at the top signifies 5000.

In abbreviations, the letter D has various significations, as, M. D. Doctor of Medicine; D. T. Doctor of Theology; D. D. Doctor of Divinity, or *dono dedit*; D. D. D. *dat. dicat, dedicat*; and D. D. D. D. *dignum Deo donum dedit*.

DACCA JELALPOOR, a district in the eastern quarter of Bengal, lying to the west of Tipperah, and between the 23° and 24° of north latitude. This district is celebrated for its abundant crops of rice, owing no doubt to the fertility derived from the annual inundations of the great rivers and numerous streams by which it is traversed. Betel-nut and a kind of cotton called *banga*, of a very superior quality, and peculiarly adapted to form the stripes of the finest muslins, are enumerated among the productions of Dacca; and plain, flowered, striped, or checkered muslins of the most beautiful fabrics, with dimities of various kinds and patterns, and cloths resembling diaper and damask linen, have long held a conspicuous place among its manufactures. The population of this district in 1801, is stated at nearly one million, of which the proportion of Mahometans to Hindoos is more than one-half.

DACCA, the capital of the district of the same name in Bengal, is situated beyond the principal stream of the Ganges, but near a large branch of that river, and about 100 miles from its mouth, and 180 miles by the road from Calcutta. The town, including the suburbs, occupies a great space of ground, and extends six miles along the banks of the river; the streets are narrow and crooked. The surrounding country is low and flat, and during the dry season is always covered with rich verdure. Great quantities of the finest muslins, which, in delicacy and beauty of fabric, surpass all other similar productions, are manufactured in the town and district, and exported from Dacca. The number of inhabitants exceeds 150,000 of whom more than one-half profess the Mahometan faith.

DACIER, ANDREW, a celebrated classical scholar, was a native of Upper Languedoc in France, and was born in 1651; studied at Saumur under M. Le Fevre, professor of Greek, and was employed as one of the commentators on the works of the ancient classics, for the use of the dauphin of France. Among others, he published editions of Pompeius Festus and Horace; and, as a reward for his labours, he received a pension from Lewis XIV. and was appointed keeper of the royal library.

In 1683 he married the daughter of his preceptor, M. Le Fevre. This lady, greatly distinguished by her classical attainments, was engaged in similar pursuits, and before her marriage had published editions of the works of Callimachus and Florus. She was also the translator of the Iliad. Madame Dacier died in 1720, and was survived two years by her husband.

DACTYL, or DACTYLUS, in Latin and Greek poetry, is a foot consisting of a long and two short syllables, as *cōrpŏră*.

DACTYLIS, COCK'S-FOOT GRASS, a genus of plants belonging to the Triandria class.

DÆDALUS was, according to ancient mythology, a most ingenious artificer, and the inventor of the wedge, various mechanical instruments, and of the sails of ships. He is the reputed descendant of Erectheus, king of Athens; and being jealous of the fame of his nephew, he put him to death, and, after that barbarous deed, fled with his son Icarus to Crete, where he constructed the famous labyrinth for Minos king of the island; but having incurred the displeasure of that prince, he was immured in the labyrinth. To effect his escape he constructed wings of feathers and wax, for himself and his son; but during their flight the heat of the sun melted the wax on the wings of Icarus, and he fell into the sea which afterwards received his name. Dædalus reached Sicily, was well received by the king of the country, and left behind him many monuments of his ingenuity. The art of Dædalus and the Dædalean art, are proverbial, and expressive of ingenuity and invention.

DÆMON, derived from a Greek word, signifying *knowing*, or *intelligent*, or to *distribute*, denotes a being or spirit superior to man, and interested in his good or bad fortune. According to the heathen philosophers, dæmons held a middle rank, and carried on all intercourse between the celestial gods and men on earth. To these dæmons was committed the entire administration of the government of this lower world, and hence they became the objects of divine worship. But the ancients believed that human spirits, after their departure from the body, became dæmons or inferior deities, at least the souls of virtuous men were advanced to that dignity, and hence became the more immediate objects of veneration. According to the ancient philosophers, dæmons were of two kinds, either benevolent beings promoting the good of mankind, or evil spirits who counteracted their happiness and prosperity; and it seems to have been a prevailing notion, that as the departed souls of good men became good dæmons, so the departed souls of bad men became evil dæmons. It is generally supposed that, by the word dæmon, is to be understood devil, in the Septuagint translation of the Old Testament; and the same word, according to the views of some authors, is always applied to human spirits in the New Testament.

DÆMONIAC is a human being who is supposed to be possessed of a dæmon, or whose mental faculties are restrained or influenced by some created spiritual being of superior power. This subject has been a fruitful source of controversy among modern writers, and particularly whether the dæmoniacal possession, which seems to have been frequent among the Jews, was to be ascribed to the direct influence of evil spirits, or to the effects of convulsive disorders. See Farmer's *Essays on Miracles, and on the Dæmoniacs of the New Testament*.

DAGHESTAN, a mountainous province of Persia, which stretches along the west coast of the Caspian sea, between Circassia and the province of Schirvan; is divided into different districts and governments, includes many beautiful and fertile vallies, is in many places populous and well cultivated, and produces abundance of wood and corn, and is now chiefly un the dominion of the Russian empire.

DAHALAC, a low flat island, and one of the largest in the Red sea; the soil is in many places sandy, and during the dry season in summer is destitute of every kind of herbage excepting a little bent grass, which affords a scanty sustenance to a few goats and antelopes, but some spots are covered with extensive plantations of acacia trees. Water is collected during the rainy season in numerous cisterns, which are said to be the work of the Persians or of the first Ptolemies. The inhabitants are chiefly employed in working the vessels which trade to the different parts of the coast, and their only manufactures are baskets, which are remarkable for their beauty and neatness. The pearl and tortoise fisheries in the vicinity of this island were in a flourishing state in the time of the Ptolemies.

DAHLIA, a genus of plants belonging to the class Syngenesia, some species of which, natives of Mexico, have been introduced into the gardens of this country, and, on account of their easy culture and rich colours, promise to be splendid ornaments.

DAHOMY, a kingdom of Africa, situated on the north coast of the gulf of Guinea, and comprehended between the 6° and the 10° of north latitude, and the 2° and the 4° of east longitude. The limits of the country have not been accurately ascertained, but the surface is known to extend in open plains, of a loose sandy soil, of a reddish colour, covered with verdure, forests, and detached patches of cultivated land. Maize, millet, manioc, yams, potatoes, tropical fruits in great variety, (among which is a small stone fruit, which has the property of converting acids into sweets, and which therefore serves as a substitute for sugar) indigo, tobacco, pepper, and cotton, are the principal of its vegetable productions, of some of which a double and even a triple crop is obtained in the course of the year. The country abounds also in deer, sheep, goats, hogs, and poultry; and in the woods are elephants, tigers, lions, and leopards. Various kinds of fish are found in the lakes and bays, and on the coast of Whydah excellent turtle are caught.

The natives, like the majority of other Africans, are an indolent and barbarous race; and, as it is to be expected in such a state of society, female degradation is complete. Women must drudge incessantly in the house or in the field, and approach their husbands and fathers on their bended knees. The father disposes of his daughters to the persons who pay him the greatest number of cowries and the largest quantity of brandy; and a man may marry as many wives as he can afford to purchase or can conveniently maintain. Temporary separation or final divorce is resorted to on very slight grounds, but adultery is slavery or death. Children are regarded rather as the property of the state than of their parents —a custom very prejudicial to the growth of filial affection. Their food consists of preparations of maize or millet flour, a rich soup, composed of flesh or fish highly seasoned. Their dress is extremely slight, and generally consists of a narrow apron or thin drawers, a felt cap or hat; sometimes a piece of cloth is wrapt round the body, and surmounted by a frock without sleeves. The men carry a club or cutlass in their hand; both sexes are provided with tobacco pouches, which also hold tinder, with a flint and steel; both sexes are also fond of finery, and are adorned with bracelets, necklaces and rings, and the scars of *tattooing;* some of them cut their foreheads and cheeks, as if they were pitted with the small-pox; in time of war the men paint their bodies and faces in the most frightful forms. They live in mud-walled and straw-thatched huts, collected into hamlets, but standing detached. They manufacture, in a rude way, warlike weapons, earthen jars and pots, cloth of cotton, and palm-tree leaves for their own use. Their religion is a very degraded and miscellaneous kind of superstition, comprehending the sun, the moon, animals, plants, and inanimate matter, as objects of devotion. They have *fetiches*, like the inhabitants of Congo, which they regard with equal veneration. A harmless serpent, which they call Da-boa, is reckoned peculiarly sacred, and has priestesses and temples.

The government is a perfect despotism, under which persons of every rank, with their lives and their property, are entirely at the will and the disposal of the king. His highest officer approaches his presence on his hands and his knees, with his head covered with dust. He has several ministers to manage the civil affairs of the kingdom, and an army of 8000 men for its defence.

DAIRY, a place appropriated for the keeping of milk and manufacturing it into butter and cheese. In the construction of a dairy-house, the chief objects are conveniency and the preservation of a proper temperature; and places of this description as well as all utensils which are employed in the different processes, should be kept in the most perfect state of cleanliness.

DAIS, a genus of plants belonging to the Decandria class.

DALBERGIA, a genus of plants belonging to the Diadelphia class.

DALEA, a genus of plants belonging to the class Diadelphia.

DALECARLIA or DALARNE, an appellation which signifies the *land of the vallies*, is a province of Sweden Proper, interposed between the 60th and the 62d parallels of north latitude, and reaching from the gulf of Bothnia west to the Doffrine hills, which separate Sweden from Norway, forming an area upwards of 300 miles in length and 100 in breadth.

Few countries can exhibit so great a variety of surface as *this land of vallies*. On the west, it is bounded by the great Alpine chain, which in a northerly direction traverses the whole of this part of Europe; thence subordinate ranges branch off, and are prolonged in a south easterly course, gradually diminishing as they proceed both in height and magnitude. One of these inferior chains passes through the northern parts of the province, dividing it from Herjeodal, Helsingeland, and Gestrickland; and another chain runs between it and Wermeland, and at Tonkoping in Smoland, it forks off into two ranges, one of which extends westward to Gottenburg, and the other eastward to the Baltic at Kalmar. The intermediate space is studded with round backed hills and knolls, the summits of which are generally covered with forests of pine. Fiall, in the neighbourhood of Norway, is the highest of the Dalecarlian mountains, and rises at least 3000 feet above the surface of the sea; but the other ranges and groups are not distinguished for their elevation, nor are they so closely covered with pine-forests as is common in the other hilly districts of Sweden, a circumstance which greatly enhances the beauty of the scenery, for nothing can be more dull or dismal than the sombre hue of a landscape which exhibits only a surface covered over with this species of tree. But the province of Dalecarlia, variegated with gently swelling hills and long winding vallies, chequered with many transparent lakes, and traversed by numerous streams and rivers, presents many richly diversified and highly pleasing prospects.

The description of the hills suggests the form of the dales, and the flow of the waters of the district. The Dal, which rises in the Doffrine mountains, and flows through the southern side of the province towards the gulf of Bothnia, is the largest of the rivers. It is broad but shallow, and slow-flowing, subject to sudden swells, and traverses in its course several large lakes. The Liusne nearly equals the Dal in magnitude, has a similar source, waters the northern side of the country, and falls at last into the gulf of Bothnia. The Clara, which also flows from the mountains on the west, and which empties itself into the lake Wenner, is the next in respect of size; but the face of the country is crossed and divided by a great variety of smaller streams which either augment the rivers or swell the lakes. The Siljar, which lies in the course of the Dal, is the most magnificent of the lakes.

This province is interesting in a geological point of view. The base consists of primitive rocks, but the surface chiefly exhibits those of a secondary kind, with the usual petrifactions. Fahlun has long been celebrated for the richness and the abundance of its copper ore, and at Eldfal are quarries of porphyry. The climate is variable but healthy; the soil, as may well be supposed, is of a stony or sandy quality, and there is nothing either in its vegetable or animal productions so peculiar as to require particular notice.

The population amounts, it is said, to 120,000, and is composed of a race of men distinguished, even from the rest of the Swedes, by several characteristic peculiarities. Their language is similar both in sound and signification to that spoken in the lowlands of Scotland. In respect of their military reputation, a Dalecarlian regiment bears about the same character in the Swedish that the 42d regiment bears in the British army. Many of them in quest of bread repair to the capital, where, like the Irish in London and the Highlanders in Edinburgh, they are employed as porters and chairmen; but still even in Stockholm they retain their provincial character, and seldom lay aside their provincial garb. This consists of a broad brimmed hat, a jockey coat clumsily made of coarse cloth, of a whitish grey colour, with horn or leather buttons, and fastened round the waist by a leathern girdle. The agriculture of the district is not skilfully managed; the plough is sometimes drawn by a single ox or cow; and oats, barley, and beans, are the principal crops; farms vary in size from the cottage croft to 300 acres in extent. The cutting down of the pine trees, squaring them into logs, or sawing them into planks, the burning of them into charcoal, or the extraction of tar and turpentine, afford employment to a great number of hands. The quarries and the mines, especially the porphyry quarries of Eldfal and the copper mines of Fahlun, occupies the industry of many more.

Fahlun, the principal town of the province, owes its existence to the oldest, and once the most productive copper mine in Sweden. The ore was concentrated in an immense cone of copper and iron pyrites, placed with the apex downwards, situated in a small plain, 300 feet above the level of the sea, and surrounded on all sides by low hills. The minerals which accompany the ore, such as actinolite, tremolite, and chlorite, seem to indicate that the mine is a series of veins in micaceous schistus. The mine has been worked from time immemorial, is now about 200 fathoms deep, and consists of many spacious galleries, the descent to which is by a winding stair. The ore is extracted both by the strokes of the mallet, and the blowing of gunpowder, in which about 600 men are employed; when it is separated and broken into convenient pieces, the ore is drawn up by perpendicular shafts, of which the number is considerable. In roasting the ore sulphur is collected, and copperas is obtained from the water of the mine. The town where all this work is carried on is regularly built in a series of parallel streets, crossed by others at right angles. The town has a population of seven thousand souls, is adorned with two churches, one of which is covered with copper, and is enriched with a cabinet of minerals belonging to the mining Company. Hedmora, situated near the southern extremity of the province, is next in rank, and is noted for its powder manufacture. Sata is built on the border of the Linstem, and has rich copper mines in its vicinity. Lecksand, Rattvik, and Funa are small villages, which, with the districts constituting their respective parishes, have each 9000 inhabitants. To facilitate the communication between these towns and the other places of Sweden, roads are made, and kept in repair, in one of which the river Dal is crossed by a bridge of a very peculiar construction. It is formed of a strong stage of square trees floating on the water, and firmly attached to each other and to the banks. Over this stage a second course of logs is imposed by way of flooring; it is defended on the sides by a parapet railing; it lies on the surface of the water; extends on both banks beyond the margin of the channel; and is elevated or depressed as the river rises or falls.

DALKEITH, a town of Mid-Lothian in Scotland, occupies an elevated spot between the North and South Esk rivers, contains nearly 5000 inhabitants, who are occupied in an iron foundery, and in the manufacture of hats, leather, soap, and candles; and is in the immediate vicinity of the extensive park attached to Dalkeith house, the residence of the Duke of Buccleugh, on the one hand, and of the grounds of Newbottle house, a seat of the Marquis of Lothian, on the other.

DALMATIA, a country in Europe, lying along the eastern coast of the Gulf of Venice, included between the 42° and the 45° of north latitude, and the 12° and 16° of east longitude, and bounded on the land side by Croatia, Bosnia, and Servia.

This large region presents a very irregular boundary line, and a surface much broken and highly deversified. The coast is deeply indented, and fringed with numerous and large islands; the windings of a river, or the sinuosities of a mountain chain, separate it from the adjacent provinces; and rugged mountains, and level plains, impetuous rivers with partially cultivated banks, pastures and forests, vineyards and corn fields, characterize the face of the country. The northern and eastern divisions are greatly elevated, and extremely precipitous, and awful from the terrible steepness, the roaring of cataracts, and the screaming of vultures. In these mountains are found abundance of white and variegated marble, very white marl, gypsum, ironstone, and asphaltes. The Cettina, the largest of the rivers, rises from four springs, which, as one of them contains trouts, are supposed to be derived from a subterranean stream, which again is thought to flow from the lake Buscoblato, 20 miles distant. The Cettina is a large river even at its source, has scooped a channel for itself deep among the mountains, and has cataracts of great magnificence in its course. When it leaves the mountains it flows placidly through a fertile country, and at last loses itself in the gulph of Venice. The Kerka, the Tatius of the ancients, flows from the mountain Topoli, and in its course towards the sea exhibits several fine cascades and tremenduous falls. The Narenta issues from the marshes of Mostar, is augmented by tributary streams, and at last empties itself into a cove of the Adriatic sea, on which it has imposed its name. All these rivers are navigable for a considerable way inland, and are well stocked with fish. Timber, corn, wine, oil, figs, and other fruits, cattle and sheep, are the principal productions of the country.

The islands off the coast are worthy of notice.—Lesina, one of the largest, extends about 44 miles in length and 8 in breadth; the centre is elevated, rugged, and barren, but the coasts are covered with corn, and fruit trees, and are well peopled. Brazza is about 30 miles long, and from 9 to 10 broad; as it is mountainous, it is liable to be parched, yet it yields wine and affords pasture. Crozola, Arba, Lissa, and others of inferior note, are nearly of the same character, both in a physical and a moral point of view; they are subject to earthquakes, and exhibit signs of volcanic origin.

The inhabitants of Dalmatia are of different races, distinguished from each other by their manners and customs, language, religion, and laws. The islands and the sea coast are inhabited by Italian colonists and emigrants, in all respects like their countrymen on the other side of the gulf. The upland districts are inhabited by a barbarian tribe known by the name of Haiducks, whose hand, like that of the Ishmaelites, is against every man, and every man's hand is against them. They dwell among (to all but themselves) the inaccessible recesses of the mountains, live by plunder, and bear a strong antipathy to the Turks, whom they frequently rob, and scruple not to kill. A third class, distinguished by the name of Morlachians, inhabit the mountain districts of Douare and Vergoraz, the vallies of Kotar, and the plains of Seign. They dwell in mean smoky huts, live on milk, thin cakes of barley, or wheaten flour, and on animal food, of which they devour a great deal at a time. They are supposed to be of Tartar origin, and resemble that race in appearance, and in many of their customs. From these statements it must be obvious, that the towns of the country will be found in the Italian department of it. Of these, Zara is a strong seaport, capital of a county of the same name, is defended by a citadel, and is the seat of an archbishop. The harbour lies toward the north, is large, safe, and well protected. In the churches are fine paintings by some of the first masters of the art; and near one of them are two fluted Corinthian columns, supposed to have been part of the temple of Juno.

Ragusa is also a sea-port, and an archbishop's see, two miles in circumference, defended by a strong fort, and carries on a considerable trade with the Turks. It is the capital of the republic of Ragusa, the territory of which stretches along the Venetian gulf.

Spalatro, a sea-port town, and an archbishop's see, is built on a peninsula on the gulf of Venice; it has a large, deep, and well-frequented harbour, and many magnificent ruins within the walls; and among these ruins the palace of Dioclesian, of which Mr Adam has published a splendid account, stands conspicuous.

Sebenico, a strong sea-port, defended by fortifications, is the seat of a bishop.

Salona, built also on the coast, was once a place of great extent, and is strewed with the ruins of its former magnificence and splendour.

Dalmatia has been the scene of many revolutions. It has successively been subject to the Romans, the Goths, and the Slavi; the king of Hungary annexed it, in the 11th century, to his dominions; in the 15th century the Venetians became its masters, but were afterwards obliged to resign the possession of a considerable part of the more inland and remote districts. It is shared at present among the Austrians, the Italians, and the Turks.

DALRYMPLE, Sir David, Lord Hailes, a judge of the civil and criminal courts of Scotland, was descended from a family of distinguished talents, and was born in 1726; received his classical education at Eton school; studied philosophy and law at the university of Utrecht, and was admitted to the Scottish bar in 1748; he was raised to the bench in 1776, and in the same year was appointed one of the lords commissioners of Justiciary; and as a lawyer and judge he was more conspicuous for the soundness of his knowledge and the probity of his character, than for the ingenuity of his remarks or the splendour of his eloquence.

But Lord Hailes is better known as the author of *Annals of Scotland*, a work in two volumes 4to, which appeared in 1776 and 1779, and in which he has traced, with indefatigable industry and the most careful research, the history of his country through a period of fourteen princes, from the middle of the 11th century to the death of David II. This work is characterised by the conciseness of the narrative and the perspicuity and simplicity of the style. In 1786, Lord Hailes came forward as a controversial writer, in *An Inquiry into the Secondary Causes which Mr Gibbon has assigned for the rapid progress of Christianity;* in which he discovers much literary acuteness and great warmth of zeal for the cause which he espouses, without the rancorous spirit which is too often associated with theological discussion. Excepting a few biographical sketches, intended as a specimen of Scottish biography, this was the last of his literary labours. In an earlier period of his life, Lord Hailes was the author of occasional papers in several periodical works, as the *World* and the *Gentleman's Magazine*. He continued the exercise of his judicial functions till within three days of his death, which took place in 1792, when he had reached the 66th year of his age.

DAMASCUS, formerly the capital of Syria in Asia, and one of the most ancient cities in the world, is supposed to have been founded by Uz, the son of Aram, and is alluded to in the time of Abraham; was long the residence of the Syrian kings; and through every period of its history seems to have experienced very remarkable vicissitudes. In all the mighty contests which agitated the powers of the East, from the time of David, king of Israel, till the period in which the Romans advanced in their victorious career to that quarter of the globe, Damascus never escaped from the struggle. Before the middle of the 7th century, it was compelled to submit to the authority of the Saracen princes, and became their principal residence; was captured and destroyed by Tamerlane in the year 1400; repaired by the Mamelukes, when they were masters of Syria; was seized by the Turks in 1506, and since that time has continued to be the capital of one of their pachalics.

The modern city, known by the different names of Damas, Domeschk, and Scham-Sherif, occupies a delightful spot in a fertile and extensive plain, about 50 miles from the sea, and which is traversed by the river Barrady, the ancient golden river; is about two miles in length, but of no great breadth; is surrounded by a strong circular wall, and has spacious suburbs. The streets are generally narrow, and the houses are chiefly constructed of bricks, composed of mud dried in the sun; but the houses which front the gardens and the squares are in a better style, and have spacious courts, adorned with trees and fountains. The market-places are elegant, and richly decorated; the castle is a large pile; and the hospital for the accommodation of strangers, and the mosque, with its cupola and minarets, are not destitute of magnificence. The church of John the Baptist, which is now converted into a mosque; the house of Ananias, which is only a small grotto or cellar; and the house of Judas, with whom Paul lodged, which includes what is supposed to be the tomb of Ananias, and is held in great veneration by the Turks, are still shewn; and a heap of gravel, about a mile distant from the east gate, marks the spot which was the scene of St Paul's vision.

The population of Damascus, estimated by some at the enormous amount of 200,000, is limited by Volney to 80,000, of whom not more than a fifth part profess the Christian faith. The manufactures are silk and cotton stuffs; and soap, and great quantities of sweetmeats and dried fruits are prepared and sent to Constantinople. The sabres of Damascus were once the most celebrated in the world for hardness and elasticity. Damascus is the centre of the commerce of Syria; and the trade receives a considerable accession during the resort of the pilgrims from the northern parts of Asia, who assemble at this city annually to the amount of thirty or forty thousand on their way to Mecca. The caravans which proceed from Damascus to Bagdad convey the productions and manufactures of the western parts of Europe, and exchange them for muslins, shawls, and other Indian goods.

The surrounding country, which includes a spacious plain of eighty miles in circumference, is remarkable for its beauty and fertility, and in the immediate vicinity of the city the pleasure-houses, turrets, and ornamental structures rising in the middle of extensive forests of the finest fruit trees, have suggested the appropriate appellation of the *orchard of Damascus*. Damascus is 23 leagues east from Sidon, and 45 north from Jerusalem.

The pachalic of Damascus is one of five similar districts into which Syria is divided, and has Palestine for its boundary on the south-west, while the desert of Arabia forms the limit on the east. The pacha of Damascus owing to the enfeebled state of the Turkish empire, possesses absolute power, and has rendered his office in a great measure hereditary; his revenue arises from a duty on lands, the capitation tax levied from Christians, from interest on money lent to merchants and farmers, from arbitrary fines and exactions, and from the privilege which he enjoys of being heir to the pilgrims who die on their journey to Mecca. His military establishment is considerable, and he is chief of the caravan, or conductor of the pilgrims, an office of great importance, and of no small emolument. On the return of the caravan from Mecca, the entrance of the pacha into Damascus is accompanied by a numerous and splendid train. Volney's *Travels in Syria and Egypt*.

DAMASK, a kind of cloth of linen or silk, ornamented with various figures. See CLOTH MANUFACTURE.

DAMIETTA, a town of Egypt, about five miles from the mouth of the Nile, and situated on its eastern bank, stands on a projecting point of land, which is bounded on one side by the river, and on the other by lake Menzale, and is of a semicircular form. Many of the houses, especially near the banks of the river, are lofty, the squares are spacious and elegant, and the mosques, with their tall minarets, the public baths, and the bazaars, or market-places, present altogether a picturesque scene.

The population of Damietta is stated at 80,000; linens of a beautiful fabric are manufactured in the surrounding villages; and the trade with Syria, some of the islands in the Mediterranean, and Marseilles, is considerable. Rice to a great amount, linens, sal ammoniac, and corn, are exported.

Some remains of antiquity, as obelisks of granite, and columns of marble and jasper, have been observed in the vicinity, which in former times was also highly celebrated for the beauty and fertility of its extensive gardens, furnished with groves of orange and other fruit trees.

DAMP, derived from a Saxon word, which signifies *vapour*, or *exhalation*, is more particularly applied to air which is generated in coal-mines, deep wells, and caverns, and is generally known under the name of *foul air*. Two kinds of damp are produced in coal mines; *choke-damp*, which is the carbonic acid gas of modern chemistry, and proves fatal to animal life the moment it is inspired; and *fire damp*, or carburetted hydrogen gas, which is not less fatal in its effects by its explosion when a burning body is brought in contact with it.

DANCE, or DANCING, has been defined an agreeable motion of the body, adjusted by art to the measures or tone of instruments, or of the voice; or the art of expressing the sentiments of the mind or the passions by measured steps, made in cadence, by regulated motions of the body, and by graceful gestures, all performed to the sound of musical instruments, or of the voice. For an account of dancing, considered as an elegant accomplishment, or an innocent recreation, see EDUCATION.

DANTE, ALIGHIERI, one of the earliest poets of modern Italy, was descended from an ancient family, and was born at Florence in 1265; was early distinguished by his talents and industry in literary pursuits; was for some time engaged in a military capacity; and finally rose to the rank of one of the chief magistrates of the Florentine republic. But this eminent station, from the distraction of parties, was full of trouble, and in the end led to the confiscation of his goods, and his exile from his native city. After being unsuccessful, along with his banished associates, in recovering possession of Florence, he retired first to Verona, and then to France, where he acquired fame in public disputations. Returning to Italy, it is supposed that he wandered about for several years in a state of poverty and dependence, till at last he was established at Ravenna, which became his residence during the remainder of his life. He was dispatched in the character of ambassador, to negociate a peace with the Venetians; but when he reached Venice his mission proved unsuccessful, and he fell into a fever of which he died in 1321, and in the 57th year of his age. His remains were honoured with a magnificent funeral, and the oration was pronounced over his ashes by Guido Novello de Polenta, his friend and patron. An elegant monument was erected to his memory; and the Florentines who had neglected him while living made repeated unsuccessful attempts to recover his bones from the city of Ravenna.

Various works, both in verse and prose, are ascribed to Dante; but by far the most celebrated is *La Divina Comedia*, a singular production, in which the author is conducted in a vision through hell, purgatory, and paradise, which furnished to the poet an opportunity of exhibiting various characters, of all ages and conditions. The title of the poem, it is said, was given because it commences with a scene of distress, and is conducted to a happy termination. In this poem, which is not free from extravagance, the author has infused many fine sentiments and sublime images, and at the same time exhibits a minute acquaintance with the passions and emotions of the human soul, while he delivers many excellent precepts and valuable maxims on the conduct of life. The appointment of a person with a public salary to read lectures on this poem in the city of Florence, affords a sufficient proof in what estimation the author was held. This happened about 50 years after his decease, and the celebrated Boccacio was the first person instituted in the office. The English reader has an opportunity of perusing La Divina Comedia in Boyd's translation of it in verse, published in 1802, to which a life of the poet is prefixed.

DANTZIC, a city of Little Pomerania in Polish

Prussia, stands about four miles from the mouth of the Vistula, is divided into three towns called the foretown or Vorstadt, the Altstadt or old town, and the Rechstadt. One of the suburbs is called Scotland, in consequence of being inhabited at one time by Scotch families, who for the service of a family of the name of Douglas, in defending the town when it was besieged by the Poles, enjoyed peculiar privileges. The city is traversed by two small streams; the houses, raised to the height of three or four stories, are constructed of brick and stone; and the chief public buildings are the cathedral, the former college of the Jesuits, the Lutheran college, the hotel de Ville, with its library and cabinet of paintings, the court of the nobles, the arsenal, and the exchange.

The harbour of Dantzic is spacious; the canal, which communicates with the Motlau, greatly facilitates commercial intercourse; and the public granaries, consisting of numerous buildings raised four or five stories high, form a separate town, surrounded by water, and having a communication with the city by means of a drawbridge.

The population of Dantzic has varied greatly at different times; in 1730 it is stated at 200,000, altho' 40,000 were carried off by the plague about 20 years before that period; but in 1804 it was estimated at 60,000, including the garrison. Woollen cloths, with gold and silver stuffs, lace, ribbons, soap, gunpowder, paper, hardware, tobacco, tanned and morocco leather, amber, varnish, and musical instruments, are enumerated among its manufactures. But Dantzic has been always celebrated for its commercial enterprise; it was the chief of the Hanse towns, and is regarded as one of the principal granaries of Europe. The exportation of corn brought from all parts of Poland is immense; beside the masts of ships and other kinds of wood, hemp and flax, potashes, honey, wax, tallow, furs, wool, and salt from Poland. Some of the chief imports are colonial produce, linen cloth, silks, brandy, and wines.

Dantzic suffered severely in the progress of the French arms in the north of Europe during the revolutionary war, from 1806, when it was besieged by that power, the whole of the suburbs destroyed, and a loss sustained equal to a million and a-half sterling, to the termination of hostilities in 1815, previously to which it had been subjected to another severe siege by the allied army.

DANUBE, the largest river of Germany, and, with the exception of the Wolga, of Europe, has its source in Suabia, runs in a north-easterly direction, till it reaches Ratisbon; is joined by the Inn, which is a broader stream, near Passau; as it approaches Linz, it changes its course to the eastward; passing Vienna, it forms a great number of islands; having reached Presburg, and entered Hungary, it moves in a south-east course towards Belgrade, and then resuming its easterly direction, forms the boundary between Bulgaria and Wallachia, and having run more than 1600 miles, discharges itself by several mouths into the Black sea. The banks of the Danube present every variety of scenery,--rugged rocks, extensive forests, rich vineyards, wide plains, covered with abundant crops of corn, many cities, towns, and villages, and innumerable castles and baronial residences of the princes and great men of the countries and districts which it traverses. In many parts of its course the Danube is navigable, and in some places for vessels of the largest size; but its channel is frequently interrupted by cataracts; the waters, being impregnated with clay, are of a yellow colour; it affords great abundance of excellent fish, and the fisheries of the sturgeon, near its junction with the Black sea, furnish means for the active industry and commercial enterprise of the neighbouring districts.

DARFUR, a central region of Africa, included between the 11th and 15th degrees of north latitude, and the 26th and 29th degrees of east longitude. Like most of the countries of that extensive quarter of the globe, the sovereign, with the title of sultan, rules with despotic sway; the people profess the Mahometan faith, but seem to be equally barbarous with the inhabitants of other districts of Africa; millet is the principal cultivated crop, beside which a little wheat and a particular kind of bean are also raised; rice, it is said, grows wild in some places; and kidney-beans, melons, cucumbers, onions, and garlic, are the productions of the garden. Some of the fruits of other tropical regions are abundant; and the quadrupeds, birds, and reptiles which are found in similar districts are common. The ores of iron and copper are met with in some places; and gold-dust collected from the soil forms a valuable commercial commodity.

The houses are chiefly constructed of clay or mud, and some of them belonging to the wealthier ranks are plastered and painted with different colours; some of the towns are said to contain 6000 inhabitants; but of the whole population of the country, stated at 200,000, and of which the Arabs form a large proportion, the greater part is distributed in numerous villages. The natives of Darfur are represented as being addicted to every vice; and, with the fortunate possession of a fermented liquid of a diaphoretic quality, it is gravely asserted that they indulge in this favourite beverage from sun-rise to sun set, without injury to their health. The Arabs are a bold, turbulent, and enterprising race.

The commercial intercourse between Darfur and Egypt is carried on by means of caravans, which arrive at Grand Cairo two or three times in the course of a-year, and sometimes, from the disturbed and unprotected state of the country, suffer an interruption of several years. A single caravan is sometimes composed of 2000 camels and 1000 slaves; the principal commodities are ivory, gum, pimento, tamarinds, ostrich-feathers, parroquets, and guinea-fowls, which are exchanged for cotton-cloths, silks, carpets, fire-arms, sword-blades, copper, tin, iron, and brass-wire, coffee, spices, and perfumes.

DARIEN, a province of Terra Firma, forming the isthmus of Darien, a narrow neck of land, which unites North and South America; has for its boundary on the north and east, the North sea and gulf or river of Darien, and the South sea and the province of Veragua on the south and west; stretches round the bay of Panama in the South sea, in the form of a crescent, for 300 miles in length and about 60 miles in breadth. The mountains of this province form part of the three chains which traverse this part of the American continent, parallel to the equator, and some of them rise to an elevation of 1200 feet. The gold mines of Choco, in the province of Darien, have been long famous for their riches. The climate is far from being salubrious. The natives, a half civilized race, retain their ferocious habits, and have never submitted to the authority of the Spaniards.

It has been long a favourite scheme to form a communication between the Atlantic and Pacific oceans; the lake of Nicaragua, which extends nearly from sea to sea, and discharges its waters by means of a navigable stream into the Atlantic, seems to offer a favourable spot for the execution of this plan; but the communication has actually been opened up since 1788, for canoes during the rainy season, near the head of the Darien river.

Darien is memorable for the settlement proposed by Paterson, a Scotchman, the original projector of the bank of England. In the accomplishment of this bold enterprise, he was successful in procuring subscriptions in Scotland to the amount of L.100,000; five large vessels, having a colony of 1200 of his countrymen on board, and furnished with provisions, military stores, and merchandise, arrived in a secure and spacious harbour in the gulf of Darien, about the end of the year 1698, and fortified the place which was selected for the settlement; but the infant colony was soon enfeebled by the climate, wasted by disease and famine, attacked by the Spaniards, and discouraged and neglected by king William and the government at home. A second expedition, with a supply of provisions, and an accession of colonists was not more fortunate, and few of those who had embarked in the enterprise survived to repeat the melancholy story of their disasters and sufferings to their mourning and disappointed countrymen.

DARLINGTON, a borough town of the county of Durham in England, stands on the declivity of a hill, has some well built streets proceeding from the market-place, and a number of modern houses, and is furnished with excellent inns. The church, in the form of a cross, is an ancient edifice with a lofty ornamented spire. The population in 1811 exceeded 5000, and the manufactures are woollen stuffs and checks, diapers, and other linen cloths; the cotton manufacture has been introduced, and the spinning of wool, hemp, and flax, by machinery, has been lately attempted, and promises to be successful. Darlington is 18 miles south from Durham.

DARMSTADT, capital of the duchy of Hesse Darmstadt in Germany, occupies a fine situation on the banks of a river of the same name, which traverses a fertile district, and is about 10 miles distant from the east bank of the Rhine. The palace, a spacious edifice, the hall of the emperors, the library, the academy of music, the schools for the instruction of youth, the cabinet of natural history, the military school, and the college, are the principal public buildings. The population is estimated at 13,000. The manufacture of harness and wheel-work is extensively carried on, and a dye-work in the house of the Orphans was at one time conducted on a large scale.

DARTFORD, a town of Kent in England, stands on the river Darent, in a narrow valley between two hills, and near the confluence of the river with the Thames, and consists of one street crossed by two others. The church and the Place-house, formerly a nunnery, which was converted by Henry VIII. into a palace, are the chief public buildings. The population in 1811 exceeded 3000, and the principal manufactures are gunpowder, for which Dartford has been long famous, and paper.

DARTMOUTH, a sea port town of Devonshire in England, stands on the river Dart, near its junction with the British channel; presents a picturesque appearance as it is seen from the bay; has a spacious street fronting the quay, and contains 3,600 inhabitants, who are extensively engaged in ship-building, in the Newfoundland fishery, the pilchard fishery, and in carrying the produce of these fisheries to the different ports of the Mediterranean.

DARWIN, Erasmus, a physician, poet, and physiologist, was a native of Nottinghamshire in England, and was born in 1731, was educated at the grammar school of Chesterfield, and even at that period produced some specimens of poetical composition. About the year 1753, he commenced his medical studies at Edinburgh; in a short time after he removed to Cambridge, and in 1755 took the degree of bachelor of medicine, and composed a poem on the death of the prince of Wales, which was afterwards admitted into the Cambridge collection of verses on that event.

Dr Darwin first attempted to settle at Nottingham, but was unsuccessful; and in 1756, he removed to Lichfield, where a fortunate recovery, which was ascribed to his skill and mode of treatment, soon brought him into extensive and lucrative practice. His marriage with a young lady of amiable manners and eminent acquirements, took place in the following year. But after a struggle with a delicate constitution for 13 years, she was carried off almost in the flower of her age, and, of a family of five children, left three sons to deplore her loss, and in a short time the surviving parent was bereaved of two of them after they had reached the period of manhood. The eldest, who had settled as an attorney at Derby, was seized with a depression of spirits, which terminated in the crime of suicide; the second, destined for the medical profession, died at Edinburgh in his 20th year, during the prosecution of his studies, and had given early promise of future eminence; and the youngest settled as a physician at Shrewsbury.

Dr Darwin resided at Lichfield about 20 years; and during that period he was not only respected on account of his professional talents, but could boast of the friendship and acquaintance of some of the most eminent characters of the time, who esteemed and admired his literary and philosophical acquirements. In 1781, he married a second wife, the widow of Colonel Pole, whom he had first seen in 1778, and for whom, even then, while she was the wife of another, if the account of his biographers be correct, he seems not to have scrupled to indulge a secret passion, a part of his conduct which cannot be approved either in a moral or a religious point of view. Soon after he removed to Derby and continued with high reputation for another 20 years of his life in the practice of his profession. In 1801, with the intention of retiring from its fatigues, he removed to the Priory, an agreeable spot about three miles from Derby. But he had not enjoyed this quiet and commodious retirement more than two months, when he was seized with his last illness, an inflammation of the lungs, to which he had been previously subject, and of which he died on the 18th April 1802, and in the 71st year of his age.

Whatever be the merits of Dr Darwin as an author, none who has perused his works will deny him the praise of extensive observation and reading, a rich fancy, and a lively imagination. The *Botanic Garden*, the composition of which, it is said, was begun in 1778, was published in 1791; and although in the construction of the verses, the application of the epithets, and the poetical embellishments in general, his art is obvious, yet in the happy allusions to ancient mythology and modern discoveries, as well as to the works of nature and the productions of art, he has contrived to infuse a charm which is altogether inimitable; and while the ear is soothed and gratified with the rich cadence of his numbers, the fancy is impressed with the force and elegance of his imagery. The copious notes relating to natural history, science, and the arts of life, annexed to this poem, give it a high additional interest. The *Temple of Nature*, or the origin of society, a posthumous publication, intended, it is said, to illustrate his medical theories, is a poem of a similar character. The prose works of Dr Darwin are also voluminous. *Zoonomia*, or the Laws of Organic Life, in 2 vols. 4to. appeared in 1794 and 1796. In this work, which contains a great mass of curious facts and observations, the author advances many singular speculations, and its effects in reforming or new-modelling medical practice has assuredly fallen far short of his expectations. *Phytologia*, or *the Philosophy of Agriculture and Gardening*, appeared in 1800, has the same speculative character, and seems to have added little to the author's reputation. Dr Darwin also published a small treatise on female education, which was intended for the direction of some near relatives, who had established a boarding school at Ashbourne; and he had a considerable share in the translation of the *Vegetable System of Linnæus*, published under the name of the Botanical society at Lichfield; and to these works may be added several memoirs in the *Philosophical Transactions*.

DASYPUS, the ARMADILLO, a genus of quadrupeds belonging to the order of Bruta. See MAMMALIA.

DATIVE, the third case in the declension of nouns, is expressive of the relation of a thing, to whose profit or loss some other thing is referred; and in English is usually denoted by the prepositions *to* or *for*. See LANGUAGE.

DATURA, the THORN APPLE, a genus of plants belonging to the Pentandria class.

DAUBENTON, LOUIS JEAN MARIE, an eminent French naturalist, was born in 1716 at Montbar in Burgundy, was educated in the college of the Jesuits, and after spending some time in the study of divinity, finally devoted himself to the acquisition of those branches of knowledge which are necessary for the medical profession, to which his views were directed; and having taken his degree in medicine, he returned to his native place, to engage in its practice. But the appointment of Buffon to the intendancy of the royal garden of Paris, led to his nomination to be keeper and demonstrator of the cabinet of natural history, when he was associated with that illustrious naturalist in his work on quadrupeds, to which he contributed the anatomical descriptions. About the time of his admission into the academy of Sciences, in which he proceeded through the different degrees of associate botanist, associate anatomist, and pensionary, he presented to that body a memoir on the methodical distribution of shells, and soon after another on the knowledge of precious stones, which was followed by other detached investigations of different subjects of natural history. His attention was also directed to vegetable physiology, and some subjects of anatomy; in 1768 he presented to the academy the results of his observations on sheep, and the improvement of wool; and at a later period, in 1782, he published *Instruction for Shepherds and the Proprietors of Flocks*.

During the horrors of the French revolution, he had the rare prudence, or the singular good fortune, to save himself from those disasters and barbarities which assailed his friends and associates; but in 1795, while in his 80th year, the venerable naturalist was compelled to present himself before the National Assembly, to demand a certificate of civism to retain a situation which he had held for 50 years; and in this contemptible farce he appeared in the character and dress of a shepherd, in allusion, probably, to the pursuits in which he had been engaged. He died in 1799, in the 84th year of his age. Beside the works alluded to, Daubenton furnished some of the treatises to the French Encyclopædia; and he had prepared and delivered lectures in the Normal school, the Veterinary school, the College of France, and the Museum.

DAUCUS, the CARROT, a genus of plants belonging to the Pentandria class.

DAVENTRY or DAINTRY, a town of Northamptonshire in England, occupies the summit and declivity of a hill between the rivers Nen and Avon, contains some good houses and many remains of religious edifices, and in the neighbourhood distinct traces of an encampment, supposed to have been a Roman station, are yet visible. The population is about 3000, and a considerable manufactory of whips has been established.

DAVIS' STRAITS, the entrance into Baffin's bay, lying to the eastward of Greenland, derives its name from John Davis, a celebrated navigator of the 16th century, who made three voyages to the arctic regions for the purpose of discovering the north-west passage to the East Indies, an account of which he afterwards published.

DAUPHINY, a province of France, having the Rhone and Savoy for its boundaries on the north and west, and Provence and the Alps on the south and east. It is now divided into the departments of Drome, Isere, and Upper Alps. It affords various valuable minerals; in some places it is fertile in corn, wine, and olives; and the principal rivers are the Rhone, Durance, Isere, and Drome.

DAX, a town of the department of Landes in

France, stands on the banks of the Adour, contains a population exceeding 4000, is chiefly celebrated for its mineral waters, and has some trade in deals, rosin, tar, wheat, wine, and brandy.

DAY is that division of time which is included between the rising and setting of the sun; but, in a larger sense, it includes the night also, and refers to a complete revolution of the earth round the sun. See CHRONOLOGY, under HISTORY.

DEACON, a person in the lowest degree of holy orders, whose duty in the church of Rome is to assist the officiating priest, or prelate, in the exercise of his functions; and in the church of England his duty is limited to the administration of baptism, reading in the church, and assisting the priest in the distribution of the holy communion. In England, a deacon is not capable of ecclesiastical promotion; and the same person cannot be ordained deacon and priest in the same day. In the church of Scotland, the office of deacon is not of a sacred nature, but extends only to the care of the poor.

DEAD SEA, a lake of Palestine, which derives this name from the erroneous reports of travellers, that its waters, being of a noxious quality, contain no living creature,—reports which have been controverted by more accurate observations. See ASPHALTITES.

DEAFNESS is the want of the sense of hearing, arising either from some imperfection in the construction or functions of the ear, in which case it is permanent, or from some disease of that organ. Permanent deafness is accompanied with the want of the power of uttering articulate sounds or the use of speech; and hence persons who are born deaf are also dumb. For the method of instructing that unfortunate class of persons, see EDUCATION.

DEAL, a town of Kent in England, stands on the shore opposite to the famous road-stead of the Downs, consists of three streets, which run parallel to the coast, and communicate with others running in an opposite direction. In the lower part of the town the streets are narrow and crowded; but in the upper part they are spacious, and adorned with houses of a later and more elegant construction. The castle is the chief object; batteries and martello-towers have been erected for the defence of the town; and among the public buildings may be mentioned the custom-house, naval store-house, and barracks. The population, including the parish, exceeds 7000; and the inhabitants are chiefly engaged in maritime affairs. A society of forty-nine pilots, for conducting ships up the rivers Thames and Medway, is established.

DEATH has been defined a total cessation of all the animal and vital functions. For the progress and signs of death, see ANATOMY.

DEBENTURE, a commercial term, denoting a kind of certificate, which entitles a merchant, exporting certain kinds of goods, to the receipt of certain bounties, drawbacks, or premiums, allowed by law for the encouragement of trade. The forms of debentures vary according to the regulations of the legislative enactments.

DEBRETZIN, a town of Upper Hungary, composed chiefly of thatched houses of a single story, and with unpaved streets. The population is stated at 30,000; manufactures of woollen stuffs, soap, saltpetre, and tobacco-pipes, have been established; and a college belonging to the Calvinists is numerously attended.

DECALOGUE, the ten commandments which were delivered by God to Moses for the moral and religious instruction of the Jews.

DECAN, or DECCAN, an Indian word, denoting the south, was formerly applied by Hindoo geographers to the extensive region on the south of the river Nerbudda. But the fixed possessions of the Mahometans, after their invasion of the Decan, having extended only to the river Krishna, the name of Decan was applied, as at the present day, to the countries between those two rivers. After the conquest of Decan by Aurengzebe, in 1690, it was divided into six vice-royalties. The chief part of the population of these extensive regions is Hindoo, especially of those provinces which are under the Mahratta government; and even the Mahometan inhabitants, under the dominion of the Nizam, who are engaged in the cultivation of the soil, have adopted the manners and customs of the Hindoos.

DECANDRIA, the tenth class of the Linnæan arrangement of plants, includes those which have flowers with ten stamens. See BOTANY.

DECEMBER, derived from the Latin word which signifies ten, was the tenth month according to the Roman mode of computation, when the year began in March, but is the twelfth or last month according to the modern division of the year.

DECEMVIRS, signifying ten men, were ten magistrates among the Romans, who were first appointed in consequence of the political struggles between the patricians and the plebeians, in the 302d year of Rome; and who possessed absolute power, and were invested with legal authority over the city. These magistrates were originally two in number, called duumvirs; and when the number was increased to ten, five were elected from the plebeians and five from the patricians.

DECIMAL ARITHMETIC is the mode of computing by decimal fractions. See MATHEMATICS.

DECLINATION is a term in astronomy, signifying the distance of any celestial object from the equinoxial either northward or southward; and the declination is said to be either true or apparent, according as the real or apparent place of the object is taken into consideration. The same term is applied to the mariner's compass, and is expressive of its variation from the true meridian of the place of observation; and in dialling it denotes the horizontal arch included between the plane and the prime vertical circle, reckoning from east to west, or between the meridian and the plane, reckoning from north to south. See ASTRONOMY, DIALLING, and MAGNETISM.

DE FOE, DANIEL, a celebrated English political and satirical writer, was the son of a butcher, and was born in London about the year 1663; was educated at the dissenting academy of Newington-green, where he continued till the 16th year of his age, soon after which period he opened a hosier's shop in Cornhill; was afterwards engaged in carrying on brick and tile

De Foe. works near Tilbury-fort in Essex; and in 1687 he was enrolled a liveryman of London. But his mind was more disposed to literature than to business; and such was the ardour, and the precocity of his genius, that he commenced, in early youth, a career of authorship, which was protracted to the termination of his life; and which embraced all the political and religious questions that agitated the turbulent period in which he lived. He first published, in his 21st year, a political pamphlet respecting the war between the Austrians and the Turks, in which he exposed the prevalent sentiment in favour of the votaries of Mahomet. He was concerned in Monmouth's enterprise against James II. and had the good fortune, on its failure, to escape unpunished; and on his return to London he published a pamphlet to warn the dissenters against the designs of King James, who, under pretence of general toleration, endeavoured to give popery not only a footing, but an ascendancy in the country, to the subversion of the established church, and of every sect of Protestant dissenters. After the revolution (an event which he had laboured to promote) he showed the satisfaction of his heart, and his loyalty to William, by joining a corps of volunteer cavalry that escorted the king and the queen from Whitehall to the mansion-house, to attend a feast given them by the lord mayor.

These pursuits proved prejudicial to his prosperity as a man of business; in 1692 he was deeply involved in debt; was forced to fly from his creditors; and one of them more impatient than the rest, took out a commission of bankruptcy against him; but on the petition of those to whom he owed the greatest sums, it was suspended, and a composition on his own simple bond was accepted. This composition was punctually paid, and, much to his honour, many of his debtors were afterwards reimbursed in full. About this time he was offered a good mercantile situation in Spain, which, through his love of living in England, he declined,—a sacrifice to patriotism which was in some measure compensated by his being appointed, without solicitation, accountant to the commissioners for managing the duties on glass, an office which he held till the suppression of the tax.

From this time he is to be regarded as a professed man of letters, and published frequent pamphlets on a great variety of subjects. On the publication of the "True born Englishman,"—a poetical satire in answer to Tuchin's "Foreigners," he was introduced to King William, by whom he was graciously received, and rewarded; and on William's demise he wrote his "Mock-mourners," with the view of ridiculing the affected grief of those, who, though they had opposed the king during the whole of his reign, expressed an affected sorrow when he died.

Soon after the accession of Queen Anne, he wrote his "Shortest way with the Dissenters," an ironical performance in which, while he assumed the language and mode of reasoning of the high church party, his object was to oppose their rancorous bigotry; and so perfect was his imitation, that his friends misunderstood his design, and were of opinion that he had deserted their cause; while his enemies, stung with the sharpness of his satire, raised a rigorous prosecution against him, by which he was convicted of publishing a seditious libel, was sentenced to be imprisoned, to stand in the pillory, to pay a fine of 200 merks, and to find sureties for his good behaviour for the space of seven years,—a severe punishment, dictated more by the suggestions of party spirit than by the demands of justice; but which the firmness of his fortitude enabled him to convert into a source of amusement, and an occasion for the display of his genius, in producing a hymn to the pillory, and an elegy on the author of the Free-born Englishman. De Foe.

During his imprisonment he commenced his Review,—a periodical work, which made its first appearance in February 1703, and was published every Tuesday and Saturday till March 1705, when a number was also published on Thursday, till May 1713, when it was entirely discontinued. This paper treated of news foreign and domestic; of trade and commerce in all their departments; and under the head entitled, a "Scandal Club," he discussed questions in divinity, morality, and criticism.

Released from prison in 1704, by Sir Robert Harley, secretary of state, through whom he also received money to pay his fine, and relieve his family, he retired to Bury St Edmunds, and was busily employed in literary and political pursuits; and while thus engaged, he was selected by government as a proper person to go to Scotland to promote the union. He arrived in Edinburgh in October 1706, where he attended all the committees of Parliament; assisted in the calculation of taxes, and repelled the objections urged against the union of the kingdom. When the bill for this important measure passed into a law, De Foe returned to London; and it is supposed that his services were rewarded by a pension from the queen.

For some time after this period he is said to have lived in comfortable circumstances at Newington, swelling his already voluminous writings, and publishing regularly his weekly reviews. But the political pamphlets, especially his "Essay on the South sea Scheme," and on a "Good Peace," the intention of which were either misunderstood or misrepresented, raised against him a host of such powerful and virulent enemies, that he found it prudent to seek for safety by a temporary retreat to the rocky recesses of the West-riding of Yorkshire. But soon emerging from his obscurity, he took an active share in the politics of the day; and the prospect of the queen's demise having excited party feelings, and raised keen discussions respecting the succession to the throne, De Foe sustained a conspicuous part, and wrote on the subjects of dispute a seasonable caution—What if the Pretender should come? and What if the Queen should die? pamphlets intended to favour the claim of the House of Hanover, but which were regarded as vindications of the right of that of Stuart, in consequence of which he was fined L.800, and again committed to Newgate. During this second imprisonment he was obliged to discontinue his reviews, and thus to end a work in the same place where it had been originally commenced.

He was liberated from prison a few months before the death of the queen, which happened in July 1714; but the rancour of his enemies did not abate with his enlargement; every scurrilous pamphlet was laid to his charge; he had been deprived of his pension; his health had declined, and his fame had become the sport of faction. In these distressful circumstances he drew up a defence of his political conduct, entitled an "Appeal to Honour and Justice." But before he had completed his design he was seized with apoplexy, induced, as is supposed, by the laborious life he had led, and the severe sufferings he had sustained. He recovered this shock, and published the "Appeal," which contains a full disclosure of the motives by which he was actuated in the composition of his numerous tracts, as well as the occasion and intention of their publication. This work closed his political career, and left him at leisure to engage in less irritating but more amusing and profitable pursuits. In 1715 he published "the Family Instructor," a work illustrative of relative duties; the Life and Adventures of Robinson Crusoe, the most popular of all his writings, followed close in its rear; and was succeeded by the "Life and Piracies of Captain Singleton," the Fortunate Mistress, Religious Courtship, the Dumb Philosopher, the History of the Devil, the Life of Colonel Jack, the History of Duncan Campbell, with a great variety of other writings; and after a long and active life, chequered by many changes, he died in April 1731, leaving behind him a widow and several children.

De Foe, as appears from the proclamation issued for his apprehension after the publication of the Shortest way with Dissenters, was a middle-sized spare man, of a brown complexion, and dark coloured hair, with a hooked nose, a sharp chin, grey eyes, and a large mole near his mouth. He wrote too much and too rapidly to write always in an accurate and elegant style; and hence, especially in his poetry, many instances of harshness, and slovenliness of language may easily be detected; but in all his writings he has left the impression of a vigorous understanding, a fine fancy, extensive knowledge, and, still more, of a very keen satire, which the matter-of-fact men of the age, greatly to his annoyance, frequently misunderstood. Few fictions are better supported, take a stronger hold of the imagination, or convey a purer or more practical morality, than the deservedly popular story of Robinson Crusoe, founded on the shipwreck of Alexander Selkirk, a Fifeshire sailor, who was cast on the island of Juan Fernandez. De Foe did not, as has been asserted, surreptitiously appropriate the papers of that mariner, but merely extended and embellished the history of his preservation and escape, as he found it published in Captain Woodes Rodger's cruizing voyage round the world. His Reviews, contained in nine thick quarto volumes, written entirely by himself, amid a great variety of other laborious and distracting avocations, afford a surprising proof of the facility and readiness with which he composed, and are supposed to have been the legitimate parents of the Tatler, Guardian, and Spectator, which form so valuable a part of British literature. Among his numerous writings (lists of which will be found in Stockdale's edition of Robinson Crusoe, and in the Biographia Britannica) are an Essay on Projects, the History of the Union between England and Scotland, and many other pieces which are still perused with interest.

DEGREE, a term in geometry, signifying the division of a circle into 360 equal parts. For the description of degrees of latitude and longitude, see ASTRONOMY and GEOGRAPHY.

DELAGOA, a bay on the east coast of Africa, discovered by the Portuguese, is about 20 leagues from north to south, and about seven leagues from east to west, is covered with numerous shoals, arising probably from accumulations of sand deposited by three rivers which discharge their waters into it. Delagoa, or English river, is navigable for vessels of considerable size 40 miles from its mouth, and for large boats nearly 200 miles. The Dutch had formerly a factory on this bay, but it is now chiefly the resort of the English South sea whalers, and the Portuguese carry on some trade in the productions of the country, which they receive in exchange for cloth, hardware, spirits, and tobacco.

DELAWARE, the smallest of the United States of America, is bounded on the east by a river and bay of the same name and the Atlantic ocean, on the north by Pensylvania, and on the west by Maryland. The greater part of this state is an extended plain, covered with a good soil, and susceptible of cultivation; but in some places the surface is broken and rugged, and in others it is swampy, or sterile and sandy. The Delaware is the principal river, and is navigable to the falls of Trenton, 155 miles from the sea, and for ships of the largest burden as high as Philadelphia, which is 120 miles distant. But several other rivers having their origin in the western parts of the state, flow into the bay of Chesapeake. In some parts of the state the pastures are rich and luxuriant; the more elevated tracts furnish a great deal of excellent timber, and the cultivated productions are wheat of superior quality, Indian corn, barley, rye, oats, buck-wheat, potatoes, and flax. The state of Delaware is divided into the counties of Newcastle, Kent, and Sussex, and the chief towns are Wilmington, Newcastle, Dover, Milford, and Lewiston.

The population is estimated at 64,000, of whom more than 6000 are slaves. Of the religious sects the presbyterians are most numerous, but the episcopalians, anabaptists, the society of friends, and methodists form also considerable bodies. The chief exports are corn and other productions of the soil, paper, iron, and salted provisions. The political constitution is similar to that of the other American states.

DELEGATES, in a general sense, are deputies or commissioners invested with authority to perform a certain duty for another, but in a more restricted meaning are commissioners appointed by the king under the great seal, for the purpose of hearing and deciding on appeals from the ecclesiastical court. These commissioners constitute the *court of delegates* in England, which is the great court of appeal in all ecclesiastical causes, and is composed of lords spiritual and temporal, judges of the courts at Westminster, and doctors of the civil law.

DELFT, a city of Holland, is situated in a rich district on the river Schie, between Rotterdam and the Hague, from which latter it is four miles distant; is defended from the encroachments of the sea by

Delhi. three dykes, and is about two miles in circumference. The city is traversed by canals adorned with trees; the streets, lined with well-built houses, are spacious and regular, and the town-house, a magnificent structure, the arsenal, and several churches, two of which are decorated with elegant monuments to the memory of illustrious characters, are the principal public buildings.

The population is estimated at 22,000. This city has been long famous for the manufacture of a peculiar kind of earthenware, which, from the place, has obtained the name of *Delft-ware*; beside which, manufactures of cloth, both of a coarse and fine fabric, and of philosophical and surgical instruments, have been established.

DELHI, a large province of Hindostan, lying chiefly between the 28th and 31st degrees of north latitude, and bounded on the north and east by Lahore, Oude, and some elevated ridges, which form the limit with Northern Hindostan, and on the south and west by Agra and Lahore; the length is estimated at 240 miles, and the average breadth at 140 miles; the climate is generally mild, and the principal rivers are the Jumna and the Ganges. The western quarter of the province suffers greatly from the want of water during the hot season; but when the rains fall and the rivers overflow their banks, a luxuriant vegetation clothes the fields with rich herbage. One quarter, long the scene of contending factions, exhibits a desolate and barren aspect, while another, abounding with mango trees of spontaneous growth, produces wheat, barley, and other grain.

The province is partly under the immediate dominion of the British, and partly subject to the authority of the native princes in alliance with the British government, or under its influence and controul; the population is considered to be inferior to some other territories in the Southern Carnatic, and the probable amount of the inhabitants, who are described as a handsome and robust race, composed of Hindoos, Mahometans, and Seiks, is supposed not to exceed five millions.

DELHI, the capital of the same name in Hindoston, and formerly the metropolis of the Mogul empire, as tradition reports, covered a space of 20 miles in extent in the period of its ancient splendour, and of which some confirmation may be drawn from its mouldering ruins. New Delhi, which stands on two rocky eminences on the west bank of the Jumna, was founded in 1631 by the emperor Shaw Jehan. It includes a space equal to seven miles in circumference, is inclosed on three sides by a wall of brick and stone, and has seven gates. Within the city the remains of splendid palaces and spacious gardens are to be seen; the mosques are numerous, many of them are in good repair, and some are distinguished by their magnificence; and, with the exception of two, which are broad and spacious, the streets are generally narrow and confined. The palace, encompassed on three sides by a stone wall, is a mile in circumference, and adjoining to it is the fortress, now in ruins. Near one of the gates is a college of great extent, but it is shut up, and without inhabitants.

In the reign of Aurengzebe, who ascended the throne in 1659, if the estimate be not exaggerated, Delhi boasted of two millions of inhabitants; but from the desolations of war the population is greatly diminished; corn, rice, millet, and indigo are cultivated on the banks of the Jumna, and cotton stuffs are manufactured in the neighbourhood; and shawls, fruit, and horses are annually brought from Cashmere and Cabul by the northern caravans. In the beginning of the 17th century, the reigning sovereign, Jehangeer, undertook and executed the magnificent project of a canal of 100 miles in length, from one part of the Jumna to Delhi; after the Persian and Afghan invasions, it was neglected and choked up; but the British government in 1810 began to repair and clear it out.

Shaw Allum, the second emperor of that name, commenced his reign in 1761; he was blinded with a dagger by a Rohillah chief in 1788; Delhi was subject to the Scindia family from the year 1770 to 1803, when it fell under the dominion of the British government, although nominally under the authority of the Mogul. Shaw Allum, the blind emperor, closed a long and disastrous reign of 44 years by his death in 1806, and was succeeded by his son Acber, who ascended the throne without tumult or popular commotion; and since his accession the suppression of crimes and the security of the persons and property of the inhabitants, by a vigorous and impartial administration of justice, have raised the value of houses and lands, and restored tranquillity and prosperity to Delhi.

Delos. DELOS, the name of two islands in the Greek Archipelago, called in modern times Dili and Sidili, or Great and Little Delos, the latter of which was one of the most celebrated spots among the ancients on account of the great veneration in which it was held. Delos was the birthplace of Apollo and Diana, and was peculiarly consecrated to the worship of these two divinities. A magnificent temple dedicated to Apollo was erected at the joint expence of the states of Greece, and one of its altars, from the peculiar art and singularity of its construction, was regarded as one of the wonders of the world. Of a marble statue of Apollo 24 feet in height, the pedestal with its inscription only remains. A brazen palmtree of large size, in allusion to Latona having suckled her twin offspring, Apollo and Diana, under a tree of that description, stood near the temple, and long remained a striking specimen of ancient art; but it was at last overthrown by a storm. Other temples were erected in Delos to other deities, among which Adrian, the Roman emperor, built two temples, which were dedicated to Neptune and Hercules.

Delos being held in such veneration, attracted great numbers of worshippers from all parts of Greece; from the resort of strangers it was greatly enriched, and, in a later period of its history, it was celebrated for its wealth and merchandise, and obtained the appellation of the *treasury and emporium of Greece*. Dying persons were removed to the neighbouring island, that this sacred spot might not be polluted with a dead body, and when such an occurrence could not be guarded against, a form of purification was practised. But this island is now entirely deserted. Great Delos, which seems from the ruins to have been adorned with splendid edifices, is also uninhabited.

DELPHI, an ancient town of Phocis, which stood on the south-west extremity of mount Parnassus, and was famous for its oracle and the temple of Apollo, which, it is said, derived its origin from a herd of goats which were feeding on the mountain, and coming near to a place from which steam or vapour issued, were seized with a peculiar feeling, that made them play and frisk about in an unusual manner. The goat-herd approaching the place to discover the cause of these strange movements, was seized with a similar enthusiasm, which was regarded as an inspiration from heaven. A temple of a simple form was at first constructed and dedicated to Apollo, who was supposed to be the author of the inspirations, and afterwards, as the reputation of these oracular responses spread through Greece, and the number of votaries and the wealth of the institution increased, a most magnificent edifice was erected. Of the influence of this oracle on the affairs of Greece, the annals of that country furnish ample evidence. No affair of moment was begun, and no enterprise was undertaken without consulting the Delphian oracle. The responses were delivered by a priestess called Pythia, who after bathing in the Castalian spring, with a crown of laurel on her head, mounted a lofty tripod, which was also adorned with laurels, and while she was seized with a paroxysm of frenzy, the supposed inspiration of the god, the sounds that she uttered were interpreted by the attendant priests.

This singular institution, which became the repository of riches and superstition, was under the protection and superintendance of the famous assembly of Amphictyons, or general council of Greece; but the direction of the religious ceremonies especially belonged to the principal inhabitants of Delphi, all of whom were entitled to officiate in the rites of the sanctuary; and even the inferior ranks of the sacred city were continually employed in festivals and processions, and in displaying all the gay pageantry of an airy and elegant superstition.

As it was well known that the wealth of Greece had been collected and amassed in the temple of Delphi, this sacred repository was often the object of plunder. An attempt of this kind was made by Xerxes, but the invaders being seized with a panic abandoned their design; the Phocensians seized the divine hoard, and the Gauls, desirous of sharing in the rich spoils, were deterred under the influence of superstition from violating the sacred place. The temple was robbed of its treasure by Sylla and Nero; and Constantine the Great, a more fatal enemy, removed the sacred tripods to adorn the Hippodrome of his new city.

DELPHINIUM, Larkspur, a genus of plants belonging to the Polyandria class, some species of which are familiar to every one as annual ornaments of the flower-garden.

DELPHINUS, Dolphin, a genus of fishes belonging to the order of Cete. See Ichthyology.

DELPHOS, a village in the province of Libadia in Turkey in Asia, and occupying part of the site of the ancient Delphi. The village consists of a few poor cottages of Albanians, which cover the very spot on which the celebrated temple and oracle of Apollo once stood. Numerous ruins, as may be expected, are scattered about, and some churches and monasteries have been erected near the village.

DELTA, a part of Lower Egypt, included between the branches of the Nile and the Mediterranean, and so called from the Greek letter of the same name, to which in form it bears some resemblance; stretches about 130 miles along the coast, from Damietta to Alexandria, and about 70 miles on the sides from the place where the Nile divides; is one of the most fertile regions of Egypt, owing chiefly to the inundations of the river; and Damietta, Rosetta, and Alexandria are the principal towns on the coast.

DELUGE, in its general meaning, denotes any great inundation, but is more particularly applied to the universal flood which, with the exception of Noah and his family, overwhelmed all the inhabitants of the earth. This deluge, which forms one of the most remarkable epochs in chronology, happened in the year 1656 from the creation of the world, or about 2,348 years before the Christian era. Beside the brief and distinct account of this remarkable event which is delivered by the sacred historian in the book of Genesis, allusions are obviously made to the same, or a similar catastrophe, in the mythology and worship or in the traditions of almost all nations. The Jewish historian, Josephus, states, that many ancient authors asserted that the world had been once destroyed by a flood; a belief of the same kind prevailed among the Egyptians, the Persians, the Chaldeans, and the Greeks; a similar tradition exists among the Chinese and the Hindoos; and it has been traced throughout the American continent, and even among some of the islands of the Pacific ocean.

DEMERARY, a settlement of Guiana on the American continent, was originally colonised by the Dutch, was reduced under the authority of Britain in 1796, and, after being restored to its first possessors, was retaken in 1803, and continues annexed to the British dominions. The river from which the settlement derives its name falls into the Atlantic ocean, after a course of 200 miles, for one-half of which it is navigable. The country is in general flat, covered with rich soil, and adorned with extensive sugar plantations. Coffee and rice are also valuable objects of culture. Stabroek is the capital of the colony; Kingston is a village, which was begun when it first came into the possession of the British, beside which some others have been erected.

DEMOCRITUS, a celebrated Grecian philosopher, was a native of Abdera, a city of Thrace, and was born about 500 years before the Christian era. Like the ancient sages, he travelled into the remote regions of Asia and Africa in quest of knowledge; and having made himself acquainted with the philosophy of the age, he finally fixed his residence at Athens. Retiring from the bustle of the world, Democritus spent his days in contemplating and investigating the works of nature; and, among many strange stories related of him, some of which may have probably derived their origin from the singularity and privacy of his life, it is said that he tore out his own eyes, that his attention might not be withdrawn from meditation; that he constantly laughed at the follies of men; and that he was charged with being a magician, or an insane person.

Adopting the atomical doctrines of his master Leucippus, he held matter to be self-existent, and originally divided into an infinite number of elementary particles, some of which were eternally intelligent, and others were eternally senseless; and to the predominating influence and controul of the intelligent portion over the crude matter, he ascribed the formation of the visible world. The same theory, arranged in a more systematic form by Epicurus, was distinguished by the appellation of the *Epicurean philosophy*. Democritus anticipated the opinions of modern astronomers, in supposing that the whiteness of the milky way is owing to the faint light of numerous clusters of stars. Having reached a very advanced period of life, it is said that he shortened his days by committing suicide.

DEMOIVRE, Abraham, a mathematician of considerable eminence, was a native of Champagne in France, and was born in 1667; but on the revocation of the edict of Nantes, being compelled to leave his native country, he settled in London, and seems to have employed himself in teaching mathematics. He was the author of several Memoirs in the Philosophical Transactions, and of some other works; but he is best known by his treatise on the *Doctrine of Chances, or Method of Calculating the Probability of Events at Play*. This work, which was dedicated to Sir Isaac Newton, first appeared in 1718. Demoivre was also the author of a *Treatise on Annuities*. He died in 1754.

DEMON and DEMONIAC; see Dæmon.

DEMOSTHENES, the most eminent of the Athenian orators, was born about 380 years before the Christian æra, and was the son of a sword-cutler in Athens, and of a woman who was partly of Scythian extraction. Little is known of his childhood or youth, except that his constitution was delicate, that he was left an orphan at the tender age of seven years, and his fortune was injured by the negligence or rapacity of his guardians. Through the same means, joined to the interruptions of sickness, his education is said to have been defective; but that, afterwards, by his own extraordinary application, he attained to an eminence, and a variety of knowledge, worthy of the high station which he was destined to sustain. The first movement of his mind towards distinction in oratory was induced, according to Plutarch, by the praises which, when a boy, he heard bestowed on Callistratus, who, in open court had successfully pled the cause of Oropus, a town of Bœotia.

When he came of age, he charged his guardians with the embezzlement of his patrimonial inheritance during his minority, and raised a process against them, with the view of recovering it. This prosecution afforded him the first occasion of speaking in public; and though his law-suit, like most others, was of little advantage to the increase of his wealth, yet the effect of his declamations on the mind of his auditors, as he flattered himself, inspired and cherished the hope that, at no distant day, he might be able to speak with applause in the public assemblies of the people. But when he ascended the *rostrum*, and addressed the citizens of Athens, his want of success is said to have been complete, and mortifying in the extreme—for his voice was weak and harsh, his utterance perplexed and indistinct, and his manner so ludicrously awkward, as to provoke no other sentiment but that of unmixed derision; so that he retired from the assembly, penetrated with sorrow, and covered with confusion. After this discouraging event, he was accosted one day as he was indolently sauntering about the Piræus, by Eunomus, the Thiasian, an old man, who spoke to him of Pericles, and encouraged him to resume his studies, that he might be enabled to sustain a part in the cause of his country; Satyrus, too, a player, is said to have pointed out to him, in a friendly manner, the defects of his elocution, and to have made him sensible how much of a public speaker's success depends on proper pronunciation and judicious gesture. On these suggestions, he betook himself again to a course of severe and solitary study. According to the account of Plutarch, he shut himself up in a subterranean apartment, that his attention might not be distracted by surrounding objects; shaved one side of his face only, that he might have no temptation to go abroad; spoke with pebbles in his mouth, that by thus exercising his organs of utterance, he might acquire a distinct and firm articulation; delivered his speeches by the sea shore, that made him raise his voice above the hoarse murmurs of the main, and give it strength, compass, and modulation; and pronounced them at home before a glass, and under a suspended sword, that he might correct the ungainliness of his manner, and cure a bad habit of twitching up his shoulders. By this discipline, he prepared himself for his next public appearance, not only to command the attention of the people, but to strike them with astonishment; and such was the accuracy of his composition, and the force of his reasoning, that the most malignant of his opponents could only allude to the elaborate polish of his orations.

About the 30th year of his age, Demosthenes made his first appearance against Philip of Macedon, and in opposition to the powerful party who, at Athens, had espoused his cause. From the first he declared himself the defender of republican principles, and the asserter of the rights and privileges of the people, whom (contrary to the reiterated admonitions of Isocrates and Phocian, with all the hirelings of Philip, to turn their arms against the king of Persia) he earnestly exhorted to assume the direction of their own affairs, to lay aside all romantic schemes of distant ambition, and to prepare manfully to repel the attacks that might be made on their own dominions, and still more on their liberties and their lives. These sentiments, set off by a sublime, glowing, and powerfully persuasive eloquence, rapidly raised him to the head of the popular party, and are said to have excited in the mind of Philip a mixed emotion of admiration and terror. His first Philippic had the effect of frustrating the design of the Macedonian to seize on the straits of Thermopylæ; but when, under the banners of Athens, and the conduct of Phocian, he took up arms against Philip, who had made an attack on the island of Eubœa, it was proved by the event that he was disqualified, either by nature or habit, from acting an honourable part as a warrior; for in the battle he is said to have been the first who abandoned his post, and the last who returned to the charge. But in the assemblies of the people, the thunders of his eloquence made the citizens ashamed of their womanish pleasures, of their newly repaired roads, their white-washed walls, and their splendid fountains, as, in his contempt of their unseasonableness and frivolity, he described the pursuits of the Athenians, when their very existence as a free state was hourly at hazard from the boundless ambition of a rapacious tyrant. In consequence of his remonstrances, some (though a very inadequate) assistance was sent to Olynthus, the walls of which were invested by Macedonian soldiers, and the hearts of some of its inhabitants corrupted by Macedonian gold; and an embassy was dispatched into the Peloponnesus to rouse the southern states against the common enemy of the liberties of Greece. But before any efficient aid could be brought to Olynthus, its gates were opened to the besiegers, who entered them in triumph,—plundered the city,—demolished the walls,—and dragged the inhabitants into servitude.

Soon after this event, embassadors from Philip arrived in Athens with proposals of peace; when Demosthenes, aware of the deep designs which these pacific overtures were intended to conceal, endeavoured to alarm his unsuspecting countrymen against the stratagems of their enemy; and had the satisfaction of hearing his arguments enforced by Æschines, who had just returned from the embassy into the Peloponnesus, where he had seen thirty young Olynthians driven like a herd of cattle as a present from Philip to some of the unworthy instruments of his selfish designs.

In this posture of affairs it was deemed proper to send Demosthenes and Æschines, with ten other persons of the first distinction, as embassadors to negociate with Philip. Unfortunately these Athenian ministers held opposite political opinions, which from the first prevented mutual confidence, and became afterwards the source of endless dissensions. On this occasion the quarrel arose between the two rival orators, and was followed by so many ill effects, both to themselves and to their country. When they arrived at the Macedonian court, Demosthenes attracted the principal share of attention; but all his firmness and fire are said to have forsaken him in the presence of Philip; he was embarrassed, and so completely lost his recollection, that he could not command a word of what he had previously prepared. He is accused, indeed, (but it is by his rival,) of having behaved before Philip, on his return home, and on two subsequent embassies, first as a simpleton, and then as a blustering detractor, and finally as a mean sycophant. But whatever was his conduct out of Athens, it is well known that at home he never ceased to expose the ambitious designs of Philip, and the destructive treason of those Athenians who abetted his cause; and it is also well known, that though he could not arrest the career of the Macedonian's aggrandizement, he was yet enabled to exert an influence which greatly impeded the facility of his progress. He induced his countrymen to oppose him in the Peloponnesus, succeeded in withdrawing the states of Argos and Messena from his alliance, and in rousing the Eubœans to drive his army from their island; he detected a plot which had for its object the destruction of the fleet in the Piræus; gained over the Thebans to act in concert with the Athenians; repaired the walls of the city at his own expense; and animated his countrymen by the praises which he bestowed on those who had fallen in the battle of Cheronæa.

For some of these services, a golden crown, on the motion of Ctesiphon, was awarded to Demosthenes, a measure which Æschines had opposed, and made the foundation of an impeachment against its adviser. On this occasion the eloquence of Demosthenes was so powerful, that it was the means, not only of rescuing his friend from danger, but of banishing his rival from Athens. Æschines, now an exile, retired to Rhodes, where he opened a school for rhetoric; and it is recorded of him, that when he read to his scholars the oration which had caused his banishment, and heard their applause, he exclaimed, "what would have been your admiration had you heard the orator himself?"

But the brilliant career of this highly gifted Athenian now approached its termination. He had survived the demise of Philip, and of Alexander, his son; but he fell before the suspicious policy of Antipater. Through that prince he was exiled from Athens, sought an asylumin the isl and Calauria, and, to escape the assassins by whom he was pursued, he swallowed poison and died. The moral and the political character of Demosthenes must be sought in the annals of Athens; and the sublimity of his genius must be studied in those specimens of his eloquence which time has transmitted to posterity. His orations which had a reference to the king of Macedon are distinguished by the name of Philippics, which has been adopted into many languages, as descriptive of a speech replete with hostility. Drs Leland and Francis have published good English translations of his orations, and they have also by several hands been rendered into French and Italian.

DEMSTER, or DEEMSTER, from the Saxon, signifying *judge*, or *umpire*, is a magistrate or judge in the Isle of Man; of which two are annually chosen for each division of the island, and, without written process, decide in matters of dispute among the inhabitants. The same appellation was given to an officer of the criminal court of Scotland, because in capital cases he pronounced the *doom* of the court, or repeated the words of the sentence after the judge. This office is now obsolete; but being conjoined with that of the common executioner, the name is still retained.

DEMURRAGE, a commercial term, expressive of a certain allowance made for the loss of time sustained beyond the period contracted for, by the detention of a ship in a port, either in discharging or taking in a cargo.

DENARIUS, a Roman silver coin, equivalent to about sevenpence three farthings of Sterling money. As a weight, it was equal to the seventh part of a Roman ounce. The term in the English law-books denotes a penny Sterling.

DENBIGHSHIRE, a county of North Wales, in

England, is bounded by Merioneth, Montgomery, and Caernarvonshires on the south and west, and by Flintshire, Cheshire, and a small portion of the Irish sea on the north and east, and is about 36 miles in length, and about 14 miles of average breadth. A double range of mountains traverses this county, and it is adorned by the beautiful and romantic vales of Clwyd, Llangollen, and Valle Crucis. Some of the mountains rise 3000 feet above the level of the sea; they are chiefly composed of argillaceous schistus, and contain productive quarries of excellent roof slate. The more elevated districts are covered with heath, peat-moss, or sheep pasture; but a rich and fertile soil prevails in the vallies, is well cultivated, and affords abundant corn crops. Limestone, coal, and lead, are met with in some places of the county. The vale of Clwyd is traversed by a river of the same name; the Conway forms the boundary with Caernarvonshire; and the Dee runs through Llangollen.

Denbighshire is divided into 37 parishes; the population in 1811 exceeded 64,000; woollen stuffs, called small cloths, constitute one of the chief manufactures of the county; the knitting of stockings and socks employs many hands; and a cannon foundery has been established near Wrexham. The trade of the county is greatly facilitated by means of the river Conway, which is navigable for small craft, but particularly by the Ellesmere canal, which enters Denbighshire at Pulsford, and is carried over a splendid aquæduct at Chirk, and over the Dee at Pontcysylte, near the bottom of Llangollen vale, by another of a still more magnificent character. The height of the central piers of this noble aquæduct is 130 feet. They are constructed of stone, and the rest of the bridge is of cast-iron; the number of arches are thirteen.

Denbigh, the capital of the county, stands on a rocky hill, on a branch of the river Clwyd. The venerable ruins of the castle are still seen on the summit of the hill, which commands a fine prospect of the most beautiful part of the vale. The population of the town in 1811 was estimated at 2714. Leather, gloves, and shoes, are manufactured to a considerable extent.

DENDERA, or TENTYRA, a town of Egypt, which stands on the west side of the Nile, and is celebrated on account of the magnificent ruins in its vicinity, which are supposed to belong to an ancient temple of Serapis.

DENDERMOND, a town of the Netherlands, which is situated at the confluence of the Scheldt and Dender, and is surrounded by marshes and fine meadows. The town, which is strongly fortified, is traversed by the river Dender; and to increase the means of defence, the country round can be readily laid under water. The population is stated at 5000. Corn, hemp, and flax are the chief productions of the vicinity, which is celebrated for a fine breed of horses; and fustians, linen, and imitations of Indian stuffs, are the principal manufactures of the town.

DENDROMETER, from two Greek words signifying *tree* and *measure*, is an instrument invented by Messrs Duncombe and Whittel, for measuring the trunk, branches, and height of a tree, at a distance. For the exclusive privilege of this instrument a patent was granted, and a detailed account of its construction and use has been published. An instrument on a similar principle has been proposed by Mr Pitt for measuring distances by a single observation, and a description of it is given in the second volume of the *Repertory of Arts*.

DENHAM, SIR JOHN, styled one of the fathers of English poetry, was the only son of Sir John Denham of the county of Essex, was born at Dublin in 1615, when his father was chief baron of the Exchequer in Ireland; was removed to England at the age of two years, when his father was appointed one of the barons of the English Exchequer, and was educated in London; was sent to Oxford in 1731, and during a three years residence in that seminary, was considered "as a dreaming young man, given more to dice and cards than study;" and having given no indications of future eminence, was not once suspected to conceal, under sluggishness and levity, those talents which were destined to improve the literature of his country. Having removed to Lincoln's inn, he prosecuted the study of the law with some degree of application, yet still indulged his propensity to gaming; and being reproved by some of his friends for his folly, he declared his resolution to reclaim himself, and, to shew the sincerity of his repentance, he wrote and published an *Essay on Gaming.* But afterwards returning to the same vice, he lost several thousand pounds which were left him by his father on his death.

The *Sophy*, published in 1642, made him first known to the public and established his reputation as a poet. Soon after he was appointed Sheriff of Surrey, and governor of Farnham castle for the king, but he held that situation only a short time; for, retiring to Oxford, he published in 1643, *Cooper's Hill*, his most celebrated poem. Denham was steadily attached to the royal family, was employed in carrying on the king's correspondence, and resided for some time in France as one of the followers of the exiled king.

During his residence in that country, his muse was not idle in the production of occasional verses to dissipate the melancholy of their condition. One of these sportive effusions, an ode or song, is on the subject of the embassy to Poland, by which he and Lord Crofts procured a contribution of ten thousand pounds from the Scotch that wandered over that kingdom in the character of itinerant traders or pedlars,—a large sum and a generous expression of loyalty, considering the persons and their circumstances from whom it proceeded. But Poland, a country of great extent, and at that time with very little commerce, was much frequented by dealers of that description, who found it a profitable business to supply those little necessaries which were out of the reach of such as constantly resided on their own estates. The success of the negociation is a sufficient proof that the number of travellers in Poland from the northern part of this kingdom engaged in that trade was not small.

In the time of the Commonwealth, what estate the war and the gamesters had left him was sold by order of parliament. But at the restoration he received the reward of his loyalty, and he was made surveyor of the king's buildings, and dignified with the order of the Bath. Soon after this time, he wrote the poem on *Prudence and Justice*, and produced a metrical *Version of the Psalms of David.* In this attempt he failed; but, as Dr Johnson remarks. "who has succeeded in sacred poetry?"

A second marriage proved the source of so much unhappiness and disquiet as to produce a temporary derangement in the mind of the poet, an occurrence which, though of a melancholy nature, did not secure him from being lampooned by the author of Hudibras. His frenzy was of short duration, and seems to have left him in full possession of his mental powers, for he wrote afterwards his excellent poem *On the death of Cowley,* whom he was destined not long to survive. He died in March 1668, and was buried by the side of that poet.

Cooper's Hill confers upon Denham the rank and dignity of an original author. It is a species of composition which may be denominated local poetry, of which the fundamental subject is some particular landscape, poetically described, and embellished with such additions as historical retrospection or incidental meditation has supplied. This poem, which has been imitated by Garth, Pope, and others, and which of itself is no small praise, is not without its faults. The digressions are too long, the morality too frequent, and the sentiments sometimes such as will not bear a rigorous enquiry. The following passage is commended by Dryden, and, though generally known and admired, is worthy of repetition.

Oh! could I flow like thee, and make thy stream
My great example, as it is my theme!
Tho' deep yet clear, though gentle yet not dull;
Strong without rage, without o'erflowing full.

The poem *on the death of Cowley,* which is characterised by musical numbers and just thoughts, was the last of his shorter works, and the best production of Denham, who is pronounced by Johnson to be "one of the writers that improved our taste and advanced our language, and whom we ought therefore to read with gratitude, though having done much he left much to do." Johnson's *Lives of the Poets.*

DENIS or DENYS, St. an ancient town in the department of the Seine, stands on a fine plain near the banks of the Seine, and about six miles north from Paris; contains a population of nearly 5000, and has manufactures of Indian stuffs, and for refining of sugar. But this place became celebrated by the abbey which was established in the sixth century, and was improved and enriched by all the succeeding kings of France, and was the burying place of the royal family. The magnificent monuments which were erected to the memory of many of the French sovereigns, were in a great measure destroyed during the frenzy of the revolution. The church was repaired and embellished by Buonaparte, and the vaults which contained the monuments of his predecessors were restored and protected, perhaps in the hope, which the course of events and the reverse of his fortunes have disappointed, that he was preparing a place of quiet repose for his own mortal remains.

DENMARK, one of the northern kingdoms of Europe, which, exclusive of Norway, that has lately been annexed to Sweden, of Iceland, and Greenland, with the rest of its foreign settlements, is comprehended between the 35th and the 57th parallels of north latitude, and the 7th and the 14th of east longitude, and is composed of several islands and a large peninsula. The islands, with the exception of a few small ones in the German and Cattegat seas, are all situated at the west end of the Baltic; and as the court and the capital are stationed in one of them, they claim the first place in the description of those dominions of which they constitute an important part.

Zealand,—the largest of these insular territories, lies in a triangular form, at the entrance into the Baltic, extends about 80 miles from south to north, and about 70 from east to west, contains a surface of 2000 square miles, and is surrounded by the Cattegat on the north, the Baltic on the south, the sound which separates it from Sweden on the east, and the Great Belt that intervenes between it and Funen on the west. The Tsiford, a deep irregular gulf, indents the northern coast; the shores consist of deep ridges of sand, and gently sloping acclivities, green with pastures, or shaded with trees; and long winding vallies, almost destitute of streams, but studded with lakes and waving with corn, characterise the surface. *Funen,* on the west, is the second island of the group in point of importance, has an area of about 60 miles in length, and about 40 in breadth, and exhibits an aspect diversified like that of Zealand. *Laaland,* off the south-west coast of Zealand, is about 30 miles long, and 20 broad; it is low and marshy, but fertile in wheat and other grain. *Falster,* which is separated from the former by a narrow channel, resembles it in respect of surface and soil, is about 20 miles long and 16 broad, and abounds in grain, fruit, and game. *Langland,* situated to the west of Laaland, takes its name from its form, being at least 30 miles in length, and scarcely 8 in breadth. Bornholm, a few leagues off the coast of Schonen, in Sweden, is of an oval form, 20 miles by 12, rocky, but fertile, and has frequently been the source of disputes between the crowns of Denmark and Sweden. Mona, off the coast of *Zealand*; Femeren, near to that of Holstein; Arroe and Alsen, Samsoe, Sproe, and Tassing, are smaller islands of the same group, and are distinguished by the same characteristics.

The peninsular dominions of Denmark extend from the river Elbe to the shores of the Skaggerack sea, where they terminate in a jutting cape, and from the shores of the German ocean across the isthmus to those of the Baltic. They comprehend Jutland, Sleswick, and Holstein. *Jutland* occupies the northern division, having Sleswick on the south, and everywhere else being encircled by the sea; it is divided into the districts of Aalburg, Wiburg, Aarhus, and Rypen; it is penetrated around its coasts by many creeks and inlets of the sea, the most remarkable of which is the gulf of Lymfiord, that, in an irregular form, crosses the country from the Cattegat to within a league of the German ocean. The face of the country is diversified with hills and heaths, lakes and marshes; it has no rivers of any magnitude, but abounds in extensive level tracts of land of a sandy soil; and the eastern districts, which are partially elevated, are in many places covered with plantations of pine, oak, beech, and birch. *Sleswick* stretches southward from Jutland to the river Eyder, has the German ocean on the west, and the Baltic sea on the east, and exhibits a surface diversified with lakes and plains, gentle eminences, and numerous woods.

Holstein is situated between the Elbe and the Eyder, the German ocean, and the Baltic sea, and comprehends Stormar, Dithmarsh, and Wagerland. This country abounds in low land, lakes, and marshes, and is consequently exposed to inundations. Connected with these countries are the islands Heligoland, Nordstrand, Amroen, Fochr, Sylt, Roem, and Mandoe, in the German ocean; and Lessaw and Anholt in the Cattegat sea.

But, besides these territories, which constitute what is commonly denominated Denmark Proper, with her dependant duchies, Swedish Pomerania, with the island of Rugen, was in 1814 ceded to the Danish crown, as an equivalent for Norway. This country borders with Mecklenburg on the west, with Prussian Pomerania on the east, by Brandenburgh on the south, and by the Baltic on the north. It is a low-lying country, intersected with rivers, among which are the Oder, the Peene, the Reckeniz, and the Warno. It contains much cultivated land, intermingled with lakes and forests, and has many good harbours on its coasts.

Rivers, lakes, and straits.—As none of these territories, broken down into so many detached portions is traversed by mountainous ranges, they are in consequence deficient in flowing streams, the Eyder being the only one entitled to the name of river that has its source within the limits of the country through which it flows. It rises in the upper regions of Holstein, and takes a westerly course toward the German ocean. The Gude, however, in Jutland, the Heveren, the Trenen, the Hips, the Colding, and the Skodborg, in Sleswick, as well as the Haer and the Trave in Holstein, are considerable streams. The Elbe, which forms the south boundary of Holstein, extends into an estuary of great magnificence, covered with vessels bearing the merchandise of Hamburg and the other trading towns which skirt its banks. But if the rivers of these regions be few, there is no want of lakes; both the insular and the continental districts are full of them; yet Ploen, the largest of them, is scarcely ten miles in circumference. The important *straits* are the Belts and the Sound; the Great Belt, between the islands of Zealand and Funen, is about 20 miles broad; the Little Belt, which is not more than nine miles across, and in some places not more than one, separates Funen from the peninsula; the Sound, where narrowest, is only three miles wide, divides Zealand from Sweden, and is the great thoroughfare of ships into the Baltic.

Minerals.—Denmark does not abound in highly elevated chains or steep precipitous cliffs, but its vegetable mould is imposed on a foundation of sandstone, accompanied with flint, chalk, gypsum, marl, sand, and peat-moss. The sand is intermingled with rolled masses of granite, gneiss, syenite, and porphyry, which must have been brought from a distance. Coal, amber, porcelain-clay, building-stones, and rock-crystal, occur in the island of Bornholm. In the neighbourhood of Oldsloe are salt-springs, which have been worked for many centuries, and from which near 20,000 tons of salt are annually obtained. The gypsum quarries of Segeberg have also been productive for a long series of years; and in the peat-mosses, whence the principal article of fuel is taken, is found a good deal of bog-iron ore.

Climate.—The greater part of Denmark may be said to have only two seasons, winter and summer, in the course of the year; for the transition from extreme cold to close suffocating heat, takes place in a very short period. The atmosphere is generally loaded with moisture, and the country, consequently, is often deluged with heavy rains, or enveloped in thick fogs. The cold commences early in October; and although occasional thaws occur even in January, yet in general it continues to accumulate till late in March, when the weather becomes milder, and the frost breaks up for the season. Vast swarms of flies, and other troublesome insects, are generated by the first heat, and continue their annoyance throughout the season. This great heat, however, and abundant moisture, forces up a rapid and luxuriant vegetation.

Soil and productions.—The soil of the greater part of Denmark is of a gravelly and sandy quality, which, by its powers of absorption, seems suited to the humidity of the climate. On the banks of the Elbe, as well as on the sea-shores in its neighbourhoood, are extensive fields formed entirely of the mud of Germany, brought down and deposited by the river, and which, when consolidated, and secured from inundations, constitute the strongest and the most productive soil in the kingdom. The uncultivated parts of the country are commonly covered with a spontaneous vegetation, composed of grasses, heaths, ferns, mosses, algæ, and fungi, indigenous to Britain and other parts of Europe. Oak, beech, and birch, are the most prevailing timber trees; the cherry, the apple, the plum, and the pear-tree, have been found to thrive in the southern districts and in some of the islands; and extensive tracts are devoted to the growth of leguminous and gramineous crops, turnips, potatoes, and culinary vegetables. Domesticated animals, such as the cow, the horse, and the hog, the sheep, the goat, and the common poultry, are numerous, and of good quality. Among the wild animals are found the wolf and the fox, the hart and the deer, the hare and the rabbit; among the winged tribes are the grouse and the woodcock, the duck, the goose, the swan, and the snipe, and a great variety and number of other aquatic birds; and the fishes which frequent the coasts, and penetrate into the gulfs, are very various, and sometimes in immense shoals.

Inhabitants.—The population of the Danish dominions in Europe, exclusive of Pomerania, is supposed to be about two millions. By the cession of Norway to Sweden, Denmark lost at a sweep nearly 800,000 of her subjects. The Danes are said to be a tall and a robust race, with fair complexions, and flaxen coloured hair. Many of them resemble the Dutch in their make; but the women, rather than the men, are distinguished by this squatness and clumsiness of shape. The peasantry are still in a state of vassalage, and are indolent and filthy, living chiefly, as well as the lower classes in the towns, on roots, salt-fish bad cheese, and oaten and rye-bread. The men are addicted to drunkenness, and, if they are not belied by Lord Molesworth, even the ladies have no objections to a dram,—a practice which the dampness and coldness of the climate may excuse, and perhaps render necessary. The nobility and upper classes have a ridiculous fondness for show, and a pernicious inclination to imitate the manners of the French: but in winter they are obliged to lay aside the fopperies of Paris, and betake themselves to their own wool, furs, and flannels. Their houses are heated with stoves, which produce a close and stifling atmosphere, and, with the want of domestic and personal cleanliness, a moist and changeful climate brings on a variety of diseases, such as fevers, agues, rheumatisms, and cutaneous eruptions.

Rural economy.—Since the year 1768, great encouragement has been given to agriculture by the operations of the Economical society founded at Copenhagen some years before. Through its exertions and munificence, treatises on improvement have been accumulated, useful implements invented, tythes have been commuted, servitudes diminished, the country extended by means of embankments towards the sea, crown-lands and city commons have been brought into the market, and advantageous and well secured leases granted to the peasants. *A chest of credit* was also, in 1786, established under the eye of government, for the purpose of encouraging agricultural improvements; from which husbandmen are entitled to borrow money at an interest of four per cent. which, with the loan, is to be paid in small instalments.

The Danish cultivators have been careful to adapt their crops to the soils and situations of a country so much diversified, so widely extended, and so far divided. Oats are cultivated, both on the main-land and in the islands; potatoes and turnips are also grown throughout the kingdom; sown grasses are not in much estimation, but great quantities of hay are annually obtained from the spontaneous herbage on the banks of the lakes; oats, rye, and buck-wheat have been found to thrive well in Jutland, Zealand, and some of the other islands; wheat, barley, beans, hops, hemp, flax, tobacco, rape-seed, and fruit-trees, are extensively cultivated in the duchies of Sleswick and Holstein, as well as in some of the islands. Jutland is rather a pastoral than a corn country, in which great numbers, both of cattle, horses, sheep, and goats, are reared. The horses of Denmark are in high repute for their beauty, action, and spirit; and prizes are awarded to those who succeed in improving the breed. The Danish cows are also deemed an excellent kind, and the dairies of the southern districts are said to rival those of Holland. In Jutland, great quantities of lean cattle are bred for exportation. The sheep of the country are numerous; they are shorn twice in the year, and cheese is made of the milk of the ewes. The culture of bees prevails in the peninsula, and in the islands of Funen, Falster, and Bornholm. Fishing is also a most important branch of Danish industry. Salmon, herrings, cod, eels, oysters, and many other kinds, are found in great abundance in the gulfs, the bays, and the lakes of the country.

Cities and towns.—A description of Copenhagen, the capital, will be found under its own name; but the subordinate towns of the kingdom may be properly introduced in this place. *Skagen*, a mean place, stands on a cape at the northern extremity of Jutland; in its vicinity a lighthouse, 64 feet high, affords direction to mariners navigating the dangerous passage to and from the Baltic. *Aalburg*, the capital of the district of that name, is an old town built on the south coast of the gulf of Lymfiord, with a good harbour, and about 4000 inhabitants. *Hiorring*, *Sabie*, and *Nykioping*, are small towns in the same district, inhabited chiefly by fishermen.

Wiburg, the capital of Jutland, is an inland town more than two miles in circuit, has several public buildings, and between 2000 and 3000 inhabitants. In former times the states of the peninsula used to meet in it to pay homage to the sovereign; and in 1528 the reformation in Denmark was begun in this town. *Mariager*, *Skeva*, and *Hobroe*, in the same district, are small places. *Aarhus*, the head of a district, and the seat of a bishop, stands in a plain between the sea and an inland lake, from which a stream proceeds and traverses the town. The harbour is shallow but safe; the public buildings are, a large cathedral, a bishop's palace, and an hospital; the trade is considerable, and the population is estimated at 15,000. *Randers*, an inland town, situated to the north-west of Aarhus, is famous for its leather gloves, fine salmon, earthen-ware, and strong beer. In its vicinity are the ruins of the castle of Droningberg. It is but indifferently built, but has a considerable trade. *Scanderburg*, a small manufacturing town, with a palace in which the kings of Denmark had formerly their residence, stands near the sea coast. *Ebletoft* and *Horsens* have good harbours, and some trade. *Rypen*, the capital of a district of the same name, is built on the west coast, and contains a castle, a cathedral, and four parish churches. *Kolding*, or *Colding*, on the banks of a stream which falls into the Little Belt, has in its neighbourhood the castle of Coldinghuus. *Fredricks-odde*, a place of some strength, in a fertile tract on the Little Belt, is built a few miles to the north-east of Kolding; at this town a toll is exacted from all vessels which pass through the strait. *Weile*, in the same vicinity, is remarkable for the picturesque nature of its situation, at the end of a valley and the head of a gulf; and also as being the place where the nobility renounced their allegiance to Christian II.

Sleswick, the capital of the duchy of that name, is situated in the form of a crescent, on an arm of the Baltic called the gulf of Scheley; the houses are chiefly of brick. The inhabitants are about 5000, but the population was once greater; and in the vicinity stands the castle of Gottorp, once a ducal residence. *Haderslaben* at the north-east extremity of the duchy of Sleswick, is a trading town, with a port for small vessels. *Apenrade*, a small thriving town at the bottom of a gulf, surrounded by hills, has frequently suffered from fire, and has a harbour exposed to the east winds. *Flensburg*, situated on a gulf which forms a good harbour, is about 16 miles north from Sleswick; its trade has decayed, and its public buildings are in ruins. *Husum*, a small town on the west coast, has suffered much from inundations; it has some trade in beer, horses, and cattle. *Fredrickstadt*, founded by a colony of Dutch Armenians after the synod of Dort, and named in honour of Frederick IV. is a regularly built flourishing town, at the confluence of the Eyder snd the Trenne. *Tonningten* on the west coast, is an open, well-built town, with a tolerable harbour, and some trade. *Eckelnfehrede*, near the south-east extremity of the duchy, is surrounded by water, has a deep port, and broad streets planted with trees.

Holstein.—The duchy of Holstein is divided into four provinces—Ditmarsh along the coast of the German ocean—Holstein between the Stor and the Eyder—Stormaria between the Stor and the Elbe—and Wagria occupying the eastern side of the country, which together contain 32 towns, and 320,000 inhabitants. *Gluckstadt* about 30 miles below Hamburgh on the Elbe, is a regularly built town, in a low marshy district, with a strong fortress, a free port, and about 4500 inhabitants. *Krempe*, amid plains and meadows, four miles from Gluckstadt, was once a strong place, but is now dismantled and reduced. *Rensburg*, a well built fortified town on the Eyder, contains about 600 houses, and a commercial college. *Kiel*, on a bay of the Baltic which communicates with a canal, is a handsome town, with a palace, a university, a college, and 800 houses; its harbour is convenient and well frequented. *Aldenburgh*, about 30 miles to the east of Kiel, though once a flourishing place, is now nearly in ruins.

The lordship of Pinneberg contains the towns of Pinneberg, Wedel, and Untersen. Altona, a few miles to the west of Hamburgh, has a gymnasium, a Jewish synagogue, and many other public buildings; it has also three docks for ship-building, and about 25,000 inhabitants employed in manufactures and trade. Hamburgh and Lubeck are imperial cities.

The island of Zealand, besides Copenhagen already described, contains several towns which deserve notice. *Elsineur*, situated on a declivity at the northern extremity of the island, and at the narrowest part of the sound, opposite to Heilinsburgh on the Swedish side, and defended by the castle of Cronenburg, is a trading sea-port town, with between 4000 and 5000 inhabitants. *Roschild*, at the extremity of the Tsifiord gulf, has a cathedral in which is the royal burying-place; it is an ancient town, but is now much decayed. The other towns of the island are *Nestwed* on the south coast; *Kioge*, a trading place; *Wordinborg*, inhabited by husbandmen and sailors; *Korsoer*, on the Great Belt; *Soroe*, a little town surrounded by lakes; *Ringsted*, where is the oldest Christian church in the kingdom; *Halundborg*, at the neck of a narrow peninsula, whence a packet-boat sails twice a-week to Aarhus in Jutland; *Holberg*, built on a branch of the Tsifiord and Nykioping, with a good harbour and some trade.

The towns in the island of Funen are, Odensee, an ancient place containing a cathedral, four churches, an hospital, and 5500 inhabitants; Nyborg, the birth-place of Christian II. on the east coast; Kiertmund, Faaborg, Sevenborg, and Alsens.

In the island of Laaland are, Naskow, the capital; Mariehoe, famous for a society of nuns; Nysted, which trades with Germany; and Saxkioping, which has some business in grain.

Manufactures.—The manufactures of woollen stuffs, cotton and linen goods, hosiery, cordage, and sail-cloth, engross a great deal of the capital, and employ many of the inhabitants of the country. Manufactures of silk have been long established, and are encouraged by the distribution of prizes, in which it is said 200,000 rix-dollars have been expended. The dog-skin gloves of Randers in Jutland, and of Odensee in Funen, as well as the saddles and harness of the latter place, are well known and much esteemed. The distillation of spirits, the refining of sugar, and the brewing of beer, are also extensive branches of business. Several iron and brass founderies have been established; and the artificers in iron, brass, and other metals are numerous. At Flensburg are many brick and tile-works; pottery and porcelain, leather, soap, starch, with a great variety of other articles in constant demand in civilized society, are likewise produced in abundance by the enterprize, industry, and skill of the artizans of the country.

Commerce.—The extensive coasts, deep gulfs, and navigable estuaries, give Denmark great facility in the exchange and distribution of mercantile commodities, and the abundance of some things and the want of others employ her in a considerable commerce. To the settlements in the northern seas, Iceland, Greenland, and the Faroe isles, she takes woollen cloth, linen, hats, ironmongery, paper, salt, and soap, meal, beer, spirits, wine, tea, coffee, and spices; and brings back hosiery, salted fish, and flesh, oil, whalebone, furs, eider down, feathers, hides, and tallow. From her West India islands, St John, St Thomas, and St Croix, she imports sugar, rum, cotton, coffee, mahogany, indigo, and tobacco, and exports to them European manufactures. In Asia also, from the coast of Africa to that of China, her Asiatic company, as well as her licensed free ships, carry out metals, spirits, gunpowder, and fire arms, pitch, and a variety of other commodities; and bring home ivory and gold, tea, porcelain, and drugs, silk and cotton manufactures, rice and spiceries. To the different ports of the Baltic, she exports the cured fish and hosiery of Iceland and the Faroe isles, and the gloves of Randers and Odensee; and imports from them hemp and flax, planks and fire-wood, potashes, cordage, iron and copper. With France, Portugal, and Spain, she exchanges horses and cattle, dairy produce, fish, and timber, for wine, brandy, fruits, salt, silk, paper, and woollen stuffs. From Germany and Holland she receives thread, wool, brandy, paper, books, seeds, and medicines, for which she gives in return horses, cattle, butter, cheese, rape-seed, fish, wood, and manufactures. Her trade with England, as it was confined chiefly to the produce of Norway, is now of course transferred to Sweden.

With the view of facilitating this extensive commerce, a communication by means of a canal was in 1784 opened between the German ocean, and the Baltic sea, across the Peninsula of Jutland. This canal commences at Kiel, on the Baltic, and terminates 23 miles to the westward, where the Eyder becomes navigable, and thence the navigation proceeds to Tonningen on the German ocean, upwards of 100 miles from Kiel. The canal admits of vessels of 120 tons burden, and is much frequented by foreigners as well as by Danes. A canal has also been cut between the town of Odensee and the sea; and of late the roads of Denmark, especially those of Zealand, have been much improved.

At Kiel, and many of the other towns of the kingdom, are annual fairs for the disposal of the productions and manufactures of different parts of the country. Except in the case of barter, the principal medium of exchange is paper currency used as the representative of the rix dollar, by which their money is counted. About five Danish rix dollars are equivalent to a pound Sterling; and each of them is divided into 6 marks, and each mark into 16 skillings. The rix dollar is not to be met with as a distinct coinage; but there are silver pieces valued at 24, 15, 10, 8, 4, and at 2 skillings. The gold ducat, the only Danish money in that metal, is equal to two rix dollars.

Various companies, such as the Insurance company, the Iceland company, the Banking company, the African, and the General company, have from time to time been established in Denmark, with the view of promoting and extending her manufactures and commerce.

Government, and Offices of State.—Till the revolution of 1660, the supreme legislative authority of Denmark belonged to the three estates of the realm, nobles, clergy, and commons,—and the executive power was vested in the crown, and a senate composed of the nobility. The crown was elective, and the right of election resided in the estates, who, in its exercise, generally kept in the same family, and gave a preference to primogeniture. Every prince, however, on his accession to the throne, was under the necessity of signing a charter of privileges, by which his royal prerogative was modified and circumscribed at the pleasure of the electors; so that the king was little more than the president of the senate and the commander of the army. But in 1660 a rupture took place between the nobles and the other two associate states, by which, in the course of four days, a government, differing little from an aristocracy, was transformed into an absolute monarchy, with the hereditary right of the crown vested in the reigning family. It is, however, fair to state that, though, according to the royal law of the realm (declared fundamental and inviolable,) the authority of the crown be altogether unlimited, yet, by the mild administration of their princes, the people have hitherto experienced few of the rigours of despotism.

The king, in the discharge of his numerous functions, is assisted by a council, in which the princes of the blood have an hereditary right to sit; in this council new laws are proposed, discussed, and receive the royal sanction. The principal offices of state are, the Chancery, to which belong the interpretation of the laws, the superintendence of public education, ecclesiastical affairs, and the poor laws,—in it also grants are drawn up, and the archives of the state deposited; the chamber of Revenue, whose jurisdiction extends over all imposts, the royal estates, forests, and highways, confiscations, fines, lotteries, and donations, mines, and internal trade; the chamber of Customs, which takes cognizance of all customs and tolls, of inferior agents, and foreign colonies; the college of Commerce, which extends to every thing relative to national industry; and the War and Admiralty offices, which have the direction of all military and maritime affairs, and whence proceed all appointments in the army and the navy. There is also a college of Finances, which suggests new taxes, and has the management of the public money.

The whole kingdom is divided into stifts-ampts, or bailiwicks, to each of which a *stifts-ampts-man* is appointed, whose duties resemble those of a lord-lieutenant of Great Britain. The king has the power of choosing and dismissing his privy councillors at pleasure; and since the revolution, it is said that unworthy foreigners have had too easy access into the royal confidence.

Court, and gradation of rank.—His Danish majesty has a guard of several companies of infantry and troops of cavalry. The chief residence of the court is at Copenhagen, and its levees and galas are conducted in the style prevalent in France in the time of Louis XIV. He has many sonorous titles, such as king of Denmark and Norway, of the Goths and Vandals, duke of Sleswick and Holstein, and several others. Among the nobility are counts, earls, and barons. The orders of knighthood are two in number; the order of the elephant, conferred on persons of the first distinction and the highest merit; and the order of Danbrog, to which private individuals are occasionally exalted. The Danes are represented as a vain people, extravagantly fond of show; and as all the officers of state take precedence of private persons, large sums are paid by many for nominal offices, with the view of enjoying the rank and consequence which they confer. The king has some hundreds of lords of the bed-chamber, who pay a considerable sum annually for the liberty of wearing a golden key.

Revenues and expenditure.—The principal resources for meeting the exigencies of the state, and defraying the expences of the royal establishment, arise from the crown lands, which originally formed the chief revenue of the kings; the land-tax, levied according to a valuation, but from which the estates of the nobility are exempted; the tithes, which since the reformation the king has divided with the clergy; the toll levied at Elsineur from all vessels passing the Sound into the Baltic, imposed at first to defray the expence of the fires kept burning in the night to direct the navigation; the stamp duties, the customs, the poll-tax, the tax on ranks, and on places and pensions.

Army.—In Denmark every peasant is enrolled at his birth in the militia lists; and is liable to serve from the age of 21 to that of 36. The militia are attached to the regular troops, and are exercised on holidays and Sundays. The regulars are clothed every three years, the militia every twelve; and both wear a red uniform, furnished by a government manufacture established for that purpose. The kingdom can muster a large military force, and the country is strongly defended by fortifications.

Navy.—During the late war the Danish navy was nearly annihilated; but as the country is entirely maritime, as multitudes of its inhabitants are sailors, and as it either possesses the materials of shipbuilding within itself, or can easily procure them from its nearest neighbours, it is reasonable to suppose that it may soon refit or regenerate its fl eet Ships of war are stationed chiefly within the fortifications of Copenhagen. Seamen are registered, and receive a small sum annually from the crown, and have the privilege of engaging in merchant ships, sailing to any part of the world, but are liable to be recalled to the service of the crown in time of war. The number of this class of sailors is 14,600. About 4000 sailors are kept constantly in the pay of the crown for the service of the navy and the work of the dock-yard. The marine-artillery consists of 800 men, divided into four companies. A ship of 90 guns has 850 men; one of 70 has 700; a frigate of 36 has 250. There is a marine academy in the capital, in which 60 cadets are maintained and instructed in the theory of navigation; volunteers are likewise admitted at their own expence into the same seminary.

Laws and courts of justice.—The whole jurisprudence of Denmark is contained in one quarto volume, divided into six books, which treat of the procedure of courts of justice,---of ecclesiastical government,---of offices and different conditions,---of maritime regulations,---of contracts, and the means of acquiring property,---and of crimes and punishments. Every thing in the volume relating to these subjects is said to be founded in equity, and to be so briefly and perspicuously expressed, that any man may quickly understand his case (and if he pleases may plead it too) without the assistance of counsel or attorney. In legal proceedings three courts have the power respectively of giving a definitive sentence on such causes as come under their cognizance; but from which an appeal lies from the lowest court to the next above it, and from that to the highest. The king is president of the supreme court, and most of the judges belong to the nobility. The judges in the inferior courts are constituted by the king's letters-patent; are amenable to him for malversation in the exercise of their office; and are obliged to make reparation to the party whom, through partiality, they may have injured. The judges have fixed salaries, which are said to be very moderate; the clerks, in their memorials and reports, are restricted to a certain number of sheets, which they must furnish at a fixed price; and so expeditious is the course of justice, that no suit, of whatever importance, hangs in suspence longer than a year and a month.

The most usual capital crimes are theft and murder; and when an accusation is preferred against any person, the case is investigated on the spot where the alleged crime is said to have been committed; and on conviction the criminal loses his life by decapitation. Treason, robbery, fraud, and forgery, are crimes which rarely occur; though, when they happen, the criminals, if detected, are punished with death.

Ecclesiastical establishment.---The Danish hierarchy consists of bishops or superintendants; provosts or arch-deacons; parish-priests and chaplains. There is no archbishop; but the bishop of Zealand is metropolitan, and has a salary of L.1000 a-year, nearly double that of any of the other sees. Each diocese is divided into districts, of which the provosts have the inspection; the districts are again divided into parishes, in each of which is a resident minister; and in large parishes are chapels of ease, with their chaplains. The parish-priests receive their salaries in glebe, tithes, surplice-fees, and in some places from the voluntary contributions of their parishioners. The value of the livings is very different in different places of the kingdom; some exceed L.400 a-year, and many are under L.20. A clergyman's widow receives the whole emoluments of the cure the year following her husband's decease, and, during her life, draws from his successor an eighth-part of the annual income. The king is patron of most of the church-livings; but some of them belong to private individuals, and to the parishes themselves. Auricular confession is retained by the clergy, which gives them a greater influence over the people than is possessed by any other of the reformed churches. Many of the clergy study at Oxford; most of them understand English, and derive the best part of their divinity from British authors. They pronounce their sermons with a great deal of action, and seldom make use of notes. The Danes are a church-going people, and observe holidays and fast-days as solemnly as they do Sundays. There are few dissenters from the established church, which, in its doctrines, rites, and discipline, is Lutheran; and it is said the clergy have often expressed their desire to have their church and that of England united into one.

Education and literature.---Parochial schools are established throughout the country, and furnished with teachers, who receive a stated salary, in which the lower classes are instructed in the more common branches of knowledge. Grammar schools, in which Latin, Greek, Hebrew, and geography are taught, are also numerous. At Copenhagen, and some other places, are institutions for the express purpose of forming schoolmasters, where, besides instruction in the branches which it will be incumbent on themselves to teach, they also exercise the art of teaching under the eye of the professors. At Copenhagen is a university well endowed, and much frequented. Kiel in Holstein, too, has a university; and in the town of Odensee is a college or gymnasium with four professors. In the capital are two schools for the children of such of the nobility and gentry as cannot afford the expence of a proper education; one for boys, the other for females.

The royal academy of Sciences, which owes its origin to six learned men, who, in 1742, were appointed to arrange the king's cabinet of medals, has published many volumes of Transactions. A Royal society was instituted in the year 1746, which had for its object the improvement of northern history and languages; and which by its publications has thrown much light on the history of the kingdom. Among the works on natural history, are the *Flora Danica*, a periodical work, published with the plates of the native plants of Denmark, both coloured and uncoloured; and the collection of rare shells, Denmark. in two volumes, engraved and coloured by Regenfuss, at the royal expence. In 1761 four men of science were sent by the king to explore Arabia; of which expedition an account was published by Niebuhr, the only survivor of these travellers. Saxo Grammaticus the historian, Tycho-Brahe, the astronomer, Holberg, Olaus, Wormius, Langebek, and many other literary and scientific characters, have at different times adorned Denmark.

Historical notices.---The Cimbri, whose memorable irruption into the southern parts of Europe about 110 years before the Christian era, and who sustained an almost total overthrow by Marius the Roman consul, are the people of whom legitimate history first makes mention as the inhabitants of these northern regions that now constitute the kingdom of Denmark.

About forty years after these events, Odin, or Woden, who is supposed to have been a Scythian chief, at the head of his plundering hordes, driven from his native country, between the Caspian and the Euxine seas, by the inroads of the Romans, founded the extensive empire of Scandinavia, in which Denmark was included. This hero, were we to give credit to Saxo-Grammaticus, was at once a poet and a priest, a monarch and a conqueror,—was exalted and revered as a god, and more eminent for his exploits than Hercules. A long line of Danish kings are enumerated as the descendants of Odin; but nothing is recorded of them or the people whom they governed, except legends of the piracies which they committed on the coasts of most of the maritime countries of Europe. Many foreign territories were, however, by means of plundering expeditions, added to their dominions; so that Canute, a name great in history, on the death of his father, in the year 985, found himself sovereign of England, Denmark, and Norway. This prince, though his prowess in war is on record, wisely chose to govern his people by the influence of equal laws more than by the force of sanguinary arms. The Christian religion had been introduced into Denmark many years before the reign of Canute; but it was not till his age that it began to gain the ascendancy over the horrid superstition long prevalent in the north, and to impart the blessings, both personal and social, with which it is fraught.

In the year 1157, Valdemar the Great succeeded to the throne, whose able government reduced to subjection, or imposed awe upon the foreign enemies of his kingdom, and brought the domestic dissensions and commotions by which it had long been distracted to an amicable termination. He extended his conquests along the southern shore of the Baltic sea, and is said to have founded the town and fortress of Dantzic, a name importing the *fort of the Danes*, and revised and published the civil and ecclesiastical laws of Scania and Zealand, which are the foundation of th: present code of the kingdom.

Valdemar was succeeded by his son, Canute VI. who first admitted the feudal law into his dominions, an event which, in the issue, entailed slavery on his people. He, however, atoned in some measure for this imprudent step, by encouraging their industry, by which prosperity and civilization were promoted. On his demise, his son, Valdemar II. obtained the crown, and, like his grandfather, was very attentive to the improvement of the laws of his realms. The code of Jutland, in particular, was published under his auspices—a system of laws which still retains its authority in the jurisprudence of the country; by it the trial by ordeal was abolished, and the verdict of a jury substituted in its place. This prince, by the will which he left behind him, divided his dominions between his two sons, Eric and Abel, but Abel procured the assassination of his brother, and took possession of his inheritance. Denmark, for a long period after this event, became a scene of insurrection, confusion, and bloodshed, in which the line of succession was frequently interrupted.

In the year 1378, Valdemar III. died without male issue, in consequence of which the states of Denmark elected Olaus, the son of Margaret, his youngest daughter, married to Haquin, king of Norway, to be his successor. Olaus, when nominated to fill his grandfather's throne, was a minor of ten years of age; and on the demise of Haquin, his father, which occurred soon after, he also in his youth succeeded to the Norwegian crown. Margaret, his mother,—a woman whose heroic talents, and successful career of ambition procured her the name of the Semiramis of the north,---had the address to obtain for herself the appointment to the regency of both kingdoms during her son's minority, with the reversion of their sovereignty in case of his death. This contingency, which had thus cautiously been provided for, actually took place seven years afterwards, and exhibited the unusual occurrence of a woman swaying the sceptre over two of the northern kingdoms of Europe. But supreme power over the united kingdoms of Denmark and Norway was not sufficient to satisfy this ambitious princess,---she aspired to that of Sweden also, which, after a series of intrigues, negociations, and battles, she succeeded in obtaining. She governed her dominions with absolute authority; and when reminded of her oaths to the nobility, of which they said they had the records: " I advise you to keep them carefully," she replied, " as I shall do the cities and castles of my kingdom, and all the rights relating to my dignity." She died suddenly in 1412, and was succeeded by Eric, her great nephew, duke of Pomerania, who, for the last 16 years of her life, had been nominally associated with her on the throne.

In 1448, Christian, count of Oldenburg, from whom the present royal family of Denmark is descended, was invested with the crown of the united kingdoms of Denmark and Norway; but Sweden resisted, and, after an arduous and expensive contest, succeeded in regaining her independence. This was a wise and virtuous prince, who exerted himself successfully to promote the peace and happiness of his people. And John, his son and successor, by the prudence and sagacity of his measures, shewed that he also was a lover of moderation. But the reign of Christian II. his son, exhibited an unhappy contrast. He is represented as dissolute, ignorant, cruel, and ambitious, aiming always at the augmentation of his power, both domestic and foreign, by any means which he could command; yet he encouraged commerce, and while he humbled the nobility and the clergy, he at the same time ameliorated the condition of the peasantry. The vices, however, which blackened his character as a man, and the ferocious cruelty, of which the massacre of Stockholm, that involved the nobility and many of the gentry of Sweden in indiscriminate destruction, stands out as a conspicuous instance, of which he was guilty as a king, have justly delivered over his name to execration and infamy. He was deposed by a general diet of the states held at Wyburg, on which he abdicated the throne, and sought an asylum in Flanders.

His uncle, Frederic, duke of Holstein, succeeded to the government of his unworthy nephew's distracted dominions. In this reign Christian II. made many abortive attempts to resume his throne; and the reformation, which had begun in Germany, now made a rapid progress throughout Denmark. Christian III. ascended his father's throne in the year 1534, after a stormy debate of the states concerning his election; and in 1536 the reformed religion was established in his dominions. The reign of Frederic II. who succeeded his father in 1648, and that of Christian IV. his son, who was left a minor in the 11th year of his age, were rendered turbulent by constant wars with Sweden, and by intestine commotions. On the demise of this latter prince, Frederic III. his son, was elected to the vacant throne, but with prerogatives retrenched and limited by a treaty between him and the states. Frederic was a prince of a gentle and an accommodating disposition, indifferent, apparently, to ambition and to glory; but when his kingdom was invaded, and his capital besieged by Charles Gustavus of Sweden, he displayed an energy, a prudence, and a perseverance of character, which has ranked him with the great both in the cabinet and in the field. His exertions in defence of his country were crowned with success; peace was concluded in 1658 between the contending powers, and in 1660 the Swedish army evacuated Zealand.

This peace was followed by a transaction which, as it changed the constitution of the kingdom, forms one of the most remarkable eras of its history. On the signature of a treaty of peace between the belligerent powers, a diet of the Danish states convened in Copenhagen, to take into consideration the exhausted and desolated condition of the kingdom. The nobles proposed an excise upon all articles of consumption, to which, notwithstanding their exemption from all taxes, they expressed their willingness to submit. But their behaviour was arrogant, and they made no secret of their design of increasing their own consequence by the diminution of the royal prerogative, and the restriction of the rising influence of the clergy and the commons. Warm debates ensued, intermingled with many reproachful expressions, in which, among other opprobious appellations, the commons were branded with the name of *slaves*. On this the assembly broke up in disorder, the clergy and the commons seceding entirely from the nobles, and retiring to a separate hall to deliberate by themselves. The consequence of this rupture, which some historians are disposed to think was preconcerted, was an offer to the king by the two seceding states of absolute power, an offer which, after some shew of resistance, he accepted, and in which the nobles, with much reluctance, were obliged to acquiesce. Accordingly, the king was absolved from all the engagements he had come under at his accession; and by a set of regulations drawn up for the occasion, entitled the *royal law* of Denmark, and declared unalterable, he, (with its transmission to his heirs both of the male and female line,) was invested with absolute authority, with no superior but God, and with power to enact, alter, repeal, and dispense with laws, to remit and levy taxes, to declare war, make peace, and form alliances.

The effects of this revolution are variously represented by different authors. It is probable, that the strong influence of custom made all those matters which affect social order and happiness proceed in the same channels in which they had been wont to flow. At any rate internal tranquillity was maintained, the mass of the people taking little interest in, and perhaps the most of them having no knowledge of the transactions in which their legislators and their rulers were engaged, but which were to determine their condition and that of their posterity. From this period downward, the Danish history is not fertile in great events. Christian IV. and his son Frederic IV. who was contemporary with Charles XII. of Sweden, renewed the war with the Swedes, and prosecuted it with various success. The two succeding potentates, Christian VI. and Frederic V. acted on pacific principles, and had more delight in exciting the industry and the enterprise of their people, than in leading them on to foreign conquest, or in causing them, actuated through emulation, by the love of false glory, to shed their blood and waste their treasure in the decision of contests in which they had no personal concern, and which ought to have been otherwise adjusted. In 1766 Christian VII. a weak prince, came to the throne. In his reign, through the intrigues of his stepmother, the queen dowager, his own consort, queen Matilda, was persecuted, and his minister Struensee, with his friend Brandt, were tortured and beheaded.

During the political convulsions which, after the French revolution, overturned many, and shook all the thrones of Europe, Denmark joined the northern confederacy against Great Britain; and in 1801, in consequence of this hostile alliance, Admiral Nelson and his squadron destroyed her fleet in the harbour of Copenhagen; and in 1807, when it was obvious, from the political state of affairs at the time, that her naval strength was on the eve of being turned against Britain, the same Admiral sailed again to Copenhagen, and after unwillingly bombarding the city, as a prudential measure, and to prevent greater evils, took possession of her fleet, and brought it, and laid it up in a British port, where it lay till the restoration of peace. By these events Denmark was greatly exasperated against Britain, and eagerly sought the assistance of France to avenge herself on her enemy as she deemed that power; and while preparations were making to attack Sweden, as the ally of Britain, Christian VII. died, and was succeeded by Frederic, who was still more eager than his father had been, to prosecute the war. Hostilities, therefore, forthwith commenced, when Denmark lost her East and West India possessions, and the isles of Heligoland and Anholt on her own coast,—losses by which her commerce was almost annihilated, and her finances sadly deranged. The disastrous expedition of Buonaparte into Russia, and his signal defeat at Leipsic, left Denmark defenceless, and greatly facilitated the execution of the ambitious design of the Crown Prince of Sweden,—the annexation of Norway to the Swedish dominions. With the utmost reluctance Frederic acceded to this curtailment of his territories, but the whole of the southern side of his kingdom was overrun with hostile armies, and he had no alternative but to acquiesce. After the king's consent was given, or rather extorted, to the separation of Norway from his dominions, the plenipotentiaries of the contracting parties met at Kiel, where a treaty was signed, by which it was stipulated, that Norway should thenceforth be ceded to Sweden,—that Denmark should receive Swedish Pomerania as an equivalent,—that she should, with the exception of Heligoland, have her captured possessions restored, and that Stralsund,---the capital of Pomerania, should be free as a depot for British goods. Thus was Denmark, for her obstinate adherence to the fortunes of France, humbled and reduced, and has now, with Norway, lost much of her political consequence among the kingdoms of Europe.

DENTALIUM, TOOTH-SHELL, a genus of shells belonging to the order of Univalves. See CONCHOLOGY.

DENTARIA, TOOTH-WORT, a genus of plants belonging to the Tetradynamia class.

DENTELLA, a genus of plants belonging to the Pentandria class.

DENYS, ST., a town of France. See DENIS, St.

DEODAND, from two Latin words, signifying "*to be given to God*," is an old law term, denoting something that is given up as a forfeit in a case of misadventure by which a person is deprived of life without blame being attached to any rational individual; as when a horse kills his keeper, or during the felling of a tree if it fall, even after warning is given to the by-standers, and kill a man, the horse and the tree are forfeited to the king for the purpose of being disposed of, and the price distributed to the poor. This charitable donation is considered as a kind of expiation for the accident; and the law is obviously derived from the Jewish law.

DEPTFORD, a town, partly in Kent, and partly in Surrey in England, stands on the banks of the Thames, where it is joined by the small river Ravensbourne, which is rendered navigable for small vessels; and is divided into the Upper and Lower town. The streets are not very regular; but many of the modern houses are built in a good style. The principal public edifices are the churches, which are adorned with elegant monuments to the memory of eminent characters, and the buildings connected with the great naval establishment, and consisting of dockyards, workshops, storehouses, and granaries, for constructing and equipping men of war. Two hospitals, destined for the accommodation and support of decayed mariners, or their widows, are liberally endowed. The population of Deptford in 1811 approached nearly to 20,000. The inhabitants are chiefly occupied in maritime affairs; but a very extensive manufactory of a kind of earthen ware called *Deptford ware*, has been established. Deptford is four miles east from London.

DERBEND, or DERBENT, a town of the province of Schirvan, stands on the west coast of the Caspian sea, and is said to have been founded by Alexander the Great, fell under the dominion of the Russians about the beginning of the 18th century, was again restored to the Persians, and now acknowledges the authority of Russia. Derbend is described as three miles in length, and was defended by a wall and citadel. The population, composed of Armenians, Mahometans, Jews, and Russians, exceeds 3000.

DERBYSHIRE, an inland county of England, situated nearly in the centre of Great Britain, and bounded on the north by Yorkshire and Lancashire, on the east by Nottinghamshire, on the south by part of Leicestershire, and on the west by Staffordshire and part of Cheshire. It lies between 52°, 38', and 53°, 27' of north latitude, and between 1, 15', and 2, 3' west longitude. Its length from north to south is about 56 miles, and its medium breadth about 20 miles, and it contains an area of 972 square miles, or 622,080, English acres.

General appearance.—The outline of this county is exceedingly irregular, being very broad at its northern extremity, and having at its southern boundary a narrow tongue tapering almost to a point. It is one of the most mountainous counties in England towards the north, while southward it is nearly a plain. The hilly district is exceedingly romantic, and constitutes the southern extremity of that range of mountains which extends through Yorkshire, Westmoreland, and Cumberland to Scotland. From these hills descend numerous streams, which water and fertilize the low meadows that extend towards the south. A striking contrast in point of scenery prevails between the northern and southern parts of this county, the former presenting little more than elevated stony regions of unconquerable sterility, or patches of lichens or stunted heath, with here and there a clump of yew trees waving on the sides of the otherwise unproductive mountain; while in other parts the most picturesque and verdant dales enliven the prospect, and relieve the eye, and on a sudden the traveller enters a tract of rich pasturage or arable ground, studded with elegant seats and thriving villages.

Mountains.—The mountains that characterize this county appear to rise very gradually from the plains below, and though at first of inconsiderable height form successive ridges, one behind another, till they attain an elevation of above 2000 feet, constituting what is called the *High Peak*. The most remarkable ridges are *Axe-edge*, about 2100 feet, and Kindu Scout, about 1000 feet above the level of the plain. Amid these rocky eminences are seen some remarkable natural caverns and passages leading far into the interior of the mountains, with occasionally a horrid chasm of seemingly unfathomable depth. The eastern part of the hilly district is called the *Low Peak*.

Rivers and canals.—The principal rivers are, the Trent, with its tributary streams, the Derwent, and the Dove, the Wye, the Rother, and the Errewash. The Trent passes through part of this county, and for a few miles forms the eastern boundary between it and Nottinghamshire, while the Dove forms part of its western boundary. Numerous rivulets contribute to supply the greater streams. Seven canals have been completed in the county, viz. the Grand Trunk canal, leading from the Trent to Wilden Ferry, the Chesterfield, from the town of that name to the Trent at the Creewash canal, the Peak forest, the Cromford, the Ashby de la Zouch, and the Derby canal.

Soil and climate.—The soil of Derbyshire is very various, especially in its northern part, where there are extensive peat-mosses, while in other places the surface consists of vegetable mould impregnated with nitre called corn-loam, occasionally mixed with marl and clay. Part of this district exhibits a thin soil on a stratum of limestone, producing fine pasturage fit for sheep. The soil in the south is chiefly marl or reddish clay, interspersed with sand and gravel, but the richest soil is on the banks of the rivers. In point of climate, this county is far from desirable, being cold and damp. A great quantity of rain falls, the winters are long and severe, and the harvests late and precarious.

Natural history.—It is chiefly in the mineral kingdom that the natural history of Derbyshire becomes interesting; and here there is ample field for examination. The mountains afford an exhaustless treasure, much of which is extremely valuable, and some of it very rare. The rocks are generally of the alluvial and secondary formations, and abound in gypsum, limestone, sandstone, slate-clay, with extensive beds of coal, and veins of lead, iron, zinc, copper, and antimony. The strata are for the most part very regular, and succeed each other in the following order. Below the red marl, which forms the external covering throughout most of the county, and which contains the gypsum and fine specimens of alabaster, lies a bed of yellow limestone, chiefly in the northern and eastern districts. Then follow the immense and thick beds that accompany the coal of this county, viz. *sandstone* of various qualities, from the hard dense kind called mill-stone grit, from the use made of it in forming mill-stones, to the loose variety that easily crumbles into sand; *slate-clay*, secondary limestone, of different varieties, alternating with amygdaloid, or *toad-stone*, as it is called. The limestone is converted into excellent lime, both for building and manure, and among it is found *tripoli* or rotten stone. Two varieties of the compounds of lime merit particular notice; the *carbonate of lime*, which sometimes appears in the state of fine marble, fitted for all the purposes of ornamental work, and *fluor spar*, which, from the beautiful variety of its colour, the high polish it receives, and the ease with which it is formed into ornaments of every shape, constitutes one of the most curious productions of the county.

The *coal* of this county is chiefly of the compact cubical kind, and each mine contains about 30 beds, of various thickness, from 6 inches to 11 feet. Several varieties of lead ore occur in veins that run at right angles to the beds of lime-stone; but the most abundant and productive of these ores is the *galena*, or blue lead ore. A curious phenomenon takes place in these lead mines, which though, when first observed, it was alarming and often dangerous, has since been advantageously employed for separating the galena from the adjacent stony matters; if a wedge or pick be driven to a moderate depth between the galena and the rock, in a short time a violent explosion takes place, the rock separates, and exposes to view a considerable surface of the lead ore. The variety of galena in which this phenomenon is usually observed is called *slickenside*, and is found in contact with calcareous spar. The iron ore, which is very abundant, is chiefly of those species called *kidney iron-stone, and common clay iron-stone*, and is found imbedded in the strata of shale and clay which accompany the beds of coal. It is very rich in metal. Zinc is procured in greater quantity than copper.

The rarest mineral production of this county, and which has hitherto been found in no other part of the world, is the *elastic bitumen*, dug up in the neighbourhood of Castletown.

Mineral springs.---This county boasts of several mineral waters, particularly those of *Buxton*, already described, (see BUXTON;) the warm springs of *Matlock*; the sulphureous water of *Kedlestone*, and the chalybeate water in the same neighbourhood. The springs of Matlock are of the temperature of 68° or 69°, and are impregnated with fixed air and a small proportion of sea salt. Of these are formed two artificial tepid baths. At Kedlestone near Derby the sulphureous spring is similar to that of Harrowgate, but weaker. It is confined within a building, near which are artificial baths. The chalybeate, situated about half a mile from the former, is strongly impregnated with *carbonate of iron* and *neutral salts*, and appears to resemble the Hartfell spa near Moffat. Near Matlock is also a well so strongly impregnated with earthy salts as to incrust whatever is placed in it, and thus to produce artificial petrifactions.

Caverns, &c.---Among the natural curiosities for which this county is remarkable, must be noticed the subterranean caverns and fissures that occur in the mountainous districts, especially near Buxton, Castleton, and Peak forest. Near Buxton is a large cavern at the foot of a limestone hill, in which are galleries of various dimensions, some winding and others straight, which lead to spacious and lofty chambers, having the roofs hung with beautiful *stalactites* of different colours, while the floor is rendered uneven by masses of similar structure, assuming many grotesque forms, which by the common people are likened to articles of furniture. Thus, as the cavern itself is called *Pooles Hole*, from a tradition that it was formerly inhabited by an outlaw of that name, these stony eminences are called his chair, table, &c. This cavern is about 770 yards in length, and belongs to the duke of Devonshire. Above this, in another hollow of the same hill, are limestone quarries and lime-kilns. The people employed in these works, amounting to near a hundred families, commonly reside in these subterraneous dwellings. Peak cavern, a natural cavity in the mountains at Castleton, is still more extraordinary. It is entered by a spacious circular arch, that leads to a sort of vestibule of sparry limestone, which gradually becomes so gloomy as to require artificial light. Within this are established two manufactures, one of tape

Derbyshire. and another of ropes, and some houses are inhabited by the manufacturers. About 30 yards beyond the vestibule, the passage contracts into a low vault, which gradually descends for about 140 feet to a small lake; on crossing which through an arch, which will not admit persons even in the sitting posture, the visitor is ushered into an enormous cavern, beyond which is another piece of water, and then a large cavern, and then a third, which exhibits the most romantic and beautiful appearance. The roof and sides are hung with large sparry icicles, which, reflecting the light of numerous torches that are carried by the guides, look like precious stones of a thousand varied shades, while the floor is beautifully smooth and even. There are also niches in the sides, in which it is customary for the guides to place human figures with musical instruments, so that the combination of sounds and sights give to this place the effect of an enchanted palace. The whole length of this surprising cavity is about 2200 feet. *Elden Hole* near Peak forest, is a remarkable chasm in the side of a rock, and has been vulgarly reported to have no bottom. It is about 30 yards long and 9 broad, but gradually contracts below the surface. About 70 yards down are two cavities, one like an oven and the other like the dome of a glass-house. Its exact depth has not been ascertained; and indeed from the bending direction of the descent, it is nearly impossible to fathom it without a personal inspection, which few persons have ventured to undertake.

The botany and zoology of Derbyshire affords little that is remarkable. Timber is not common, except in the plantations round the seats of the nobility and gentry; and upon the rocky hills few trees or shrubs appear, except the yew and the mountain-ash. The animals are similar to those found in the adjoining counties, and the usual fresh-water fish are taken in the rivers, especially trout and graylings in the Dove.

Antiquities.---The hand of time has left numerous remains of antiquity in this county, which are the more remarkable, as they refer to the three earliest periods of British history. Those artificial risings called barrows, the circular assemblages of large separate stones, situated betwixt Wirksworth and Buxton, on Stanton moor, and in some other places, and the rocking stones in several parts of the northern district, are evidently British. To the Roman period belong two roads, one leading from Staffordshire across this county to Chesterfield, called *Ilkenild*, and the other extending for 20 miles between Brough and Buxton, and denominated the Bathway, and some encampments on Pentridge common, and on a hill near Castleton called *Mam Tor.* Of a subsequent period, probably the Saxon, there remain a remarkable castle on the summit of the hill containing the Peak cavern, which has given the name of Castleton to the village beneath, a place formerly of considerable strength, and noted in the topographical history of the district, for the achievements and tournaments of which it was the scene; Codnor castle, a fortified baronial mansion, which with its adjacent domain occupied 2000 acres of ground; and a small portion of a castle near Derby, belonging to the Earl of Chesterfield.

Population.---The total number of the inhabitants of this county, as estimated in the returns made to parliament in 1801, was 161,142, with rather a greater proportion of females. According to the returns in 1811, the numbers had increased to 185,487, shewing an accession in ten years of 24,345 persons. Derbyshire.

Divisions.---Derbyshire is divided into six hundreds, viz. Appletree, High Peak, Molleston and Litchurch conjoined, Repton and Cresby conjoined, Scaresdale, and Wirksworth; and these hundreds comprehend 116 parishes. The chief towns are, Derby the county town, Chesterfield, Buxton, Ashbourn, Alfreton, Wirksworth, Bakewell, Tideswell, and Bolsover. Of these, an account of Chesterfield, Buxton, and Bolsover, has already been given in this work, under their respective heads. A description of the remainder now follows.

Seats.---Among the seats which decorate this county, the principal are, *Chatsworth* near the Peak belonging to the Duke of Devonshire; *Kedlestone-hall* about three miles from Derby, the magnificent mansion of Lord Scarsdale; *Haddon-hall* near Bakewell, the property of the Duke of Rutland; and *Hardwicke-hall,* another seat of the Duke of Devonshire, formerly belonging to the Earls of Shrewsbury, and celebrated as having been the prison of Mary Queen of Scots, while in England.

Husbandry.---Considering that this is a manufacturing district, and that the cultivated land is confined within narrow limits, the agriculture of Derbyshire is respectable, and is progressively improving. In the northern part of the county the farmers are employed chiefly in feeding and breeding cattle. In particular, great attention is paid to the breed of cows, which are among the best in the kingdom. The milk is used chiefly in making cheese, of which nearly 2000 tons are annually carried to market. In quality it ranks next to Gloucester. Two breeds of horse are reared; one in the north, small, but hardy and active; the other, in the southern farms, large, heavy, and fit for draught. The sheep, fed on the short fine herbage of the hilly districts, are smaller, and produce better mutton than those of the south. Tillage is carried on to the greatest extent in the eastern district, and about Derby, where grain of all the usual kinds is produced in abundance. Artificial grasses are commonly cultivated, and turnips and cabbage for the cattle are very general crops. The system of fallowing every third or fourth year is still pursued. The growing of chamomile flowers is a lucrative branch of husbandry.

Manufactures and trade.---Most of the manufactures fall to be noticed under Derby. Besides those, there are large cotton-works at Cromford, established by the celebrated Sir Richard Arkwright; the manufacture of wool into cloth, and of worsted stockings, is carried on in the eastern villages; iron is wrought at about twenty blast-furnaces, chiefly in the north-east borders; and ornaments of spar are made in various places in the neighbourhood of the Peak. The chief export trade consists of lead, iron, cattle, cheese, and chamomile flowers.

History, &c.---When the Romans invaded Britain, Derbyshire sheltered the tribe of the *Coritani,* and was by the conquerors included in the province of *Flavia Cæsariensis.* In the Saxon heptarchy it formed part of the kingdom of *Mercia*. In 837 it yielded, with the other territories of the king of *Mercia*, to Egbert, and was from that time attached to the crown of England. Four members are returned to the house of Commons, two for the county and two for the town of Derby. The county forms part of the midland circuit; and the assizes and three of the quarter-sessions are held at Derby, while the fourth quarter-session is held at Chesterfield. The county is in the diocese of Lichfield and Coventry, and has six deaneries, viz. High Peak, Ashbourn, Castillar, Chesterfield, Derby, and Reppington.

Derby, the chief town of the county, is situated in a valley on the western side of the river Derwent, on a gentle eminence, expanding into a fine well-cultivated plain; it is well-built, and has a handsome market-place. The principal public edifices are, five churches, of which that of All Saints is the most admired, and affords an elegant specimen of Gothic architecture; a convenient town-hall; a county jail; a handsome assembly-room, situated in the market-place; a commodious theatre; and one of the best-planned infirmaries in the kingdom. This town also contains many charitable institutions, especially three alms-houses, one called the *Devonshire alms-house*, for eight men and four women; another for eight men and women; and a third for the widows of clergymen; and three free-schools for the education of the poor. Near the infirmary is a large depot for ordnance, in which is an armoury capable of containing 15,000 stand of arms. The manufactures of Derby are very important, particularly those of silk and cotton. The silk-mill in this town is the oldest and most extensive in the kingdom. It owes its establishment to a mechanic named *John Lombe*, who, for the service he rendered to his country in introducing this manufacture, was rewarded with a grant of L.15,000, and received the honour of knighthood. This mill is supported on 13 stone-arches, is 110 feet long, 39 broad, and 53 high, and employs about 240 persons. The silk and cotton-mills belonging to Messrs Strutt, are also extensive, and of very ingenious construction. The manufacture of porcelain, established about 70 years ago, has a high reputation. Numerous ornamental articles, constructed from the alabaster, marble, and fluor-spar, found in the county, are also made in this town. The other manufactures are chiefly those of stockings, plate-iron, tin-plate, leaden-pipes, shot, and red and white lead. Bleaching and dyeing are also carried on to some extent; and lapidaries and jewellers find considerable employment. Derby in 1811 contained 2644 houses, inhabited by 2924 families, comprehending a population of above 13,000 individuals. Distance from London 126 miles.

Ashbourn, a market-town, situated on the borders of Staffordshire, near the river Dove, over which it has a stone-bridge. It was formerly large and populous, but has been for some time declining. It carries on a considerable trade in exporting the cheese made in the neighbourhood. Distance from London 159 miles.

Alfreton, a place of great antiquity, said to have been built by Alfred the Great, stands in a delightful situation, on a small hill six miles from Chesterfield, and 144 N.W. of London. It is a market-town and has fairs for horses.

Wirksworth, a thriving and populous town, forming the chief emporium for the lead produced in the county; is situated in a valley near the source of the small river Ecclesburn. Eight miles from Derby and 139 from London.

Bakewell, a very ancient town, which may be traced nearly to the Roman period, is built on the river Wye, near its confluence with the Derwent. It has an elegant church, with an octagonal tower, surmounted by a lofty spire. Here Sir Richard Arkwright erected a large cotton-mill, which employs about 200 persons. Being in the neighbourhood of the Peak, it is also a convenient mart for the lead trade. Population about 1400. Distance from London 151 miles.

Tideswell, situated near the borders of Nottinghamshire, about 158 miles from London, noted chiefly for its manufacture of woollen goods. It is said to derive its name from a well in the neighbourhood, the water of which ebbs and flows like the sea.

DEREHAM, or Market Dereham, a town of Norfolk in England, about 16 miles west from Norwich, and with a population estimated at 3000.

DERHAM, Doctor William, an English philosopher and divine, was a native of Worcestershire, and was born in 1657, and educated at Oxford. He was first settled as a clergyman in Berkshire, and in 1689 was presented to the rectory of Upminster in Essex, the vicinity of which to London afforded him an opportunity of frequent intercourse with those who were engaged in the kindred pursuits of natural and experimental philosophy, to which he himself was early attached. Numerous detached memoirs on subjects of natural history, mechanics, and astronomy, by Dr Derham, have appeared in the transactions of the Royal society; *the Artificial Clock-maker* was published while he was a young man; and in 1711, 1712, 1713, and 1714, he preached the sermons at Boyle's lecture, which he afterwards digested under the familiar titles of *Physico-Theology*, and *Astro-Theology*, or demonstrations of the being and attributes of God from his works of Creation, and a survey of the heavens,—works which have been long deservedly popular. Dr Derham died in 1735, when he had reached the 78th year of his age.

DERMESTES, a genus of insects belonging to the order of Coleoptera. See Entomology.

DERRY, a town and county of the north of Ireland. See Londonderry.

DERVIS or DERVICH, derived originally from the Persian, signifying a *beggar*, or *one who has nothing*, is a person belonging to a religious order in Persia and Turkey, who subjects himself to a very austere life, professes great poverty, and travels about seeking alms. In their institutions and habits, the dervises resemble the monastic orders of Christian countries.

DESAGULIERS, John Theophilus, a natural philosopher, was the son of a French clergyman, and a protestant refugee; was born at Rochelle in 1683; while an infant, was brought to England by his father, and having finished the elementary part of his education, studied at Oxford, where he succeeded

Dr Keil in reading lectures on natural philosophy. He settled in London in 1712, and commenced lectures of the same kind in the metropolis, which he continued to the end of his life in 1749. As he had entered into the clerical profession, he was appointed chaplain, first to the Duke of Chandos, and afterwards to the Prince of Wales. He communicated many memoirs on optical, mechanical, and meteorological subjects, to the Philosophical Transactions, and he was the author of *A course of Experimental Philosophy*, in 2 vols. 4to.

DESCANT, a term in music, denoting a composition in several parts; *plain* descant, which is the foundation of all musical compositions, consists in the proper arrangement of many concords, and is analagous to simple counter-point; *figurative* descant is that part of an air in which, for the sake of variety, some discords are introduced, and may be considered as the ornamental part of music; and *double* descant is that kind of composition in which the parts are so contrived that the treble or any high part may become the base, and the base may be substituted for the treble.

DESCARTES, Rene du Perron, a celebrated French philosopher, was descended from an ancient family, and was born in Touraine in 1596. Disposed even in early childhood to investigate and discover the causes of every thing that came under his observation, he was known in his family under the appellation of *the philosopher*. The feeble state of his health precluded him from attendance at a public school till his eighth year, when he entered the college of the Jesuits at La Fleche, and for eight years more prosecuted the study of metaphysics and mathematics with uncommon assiduity. He then returned to his father, who had destined him for the military profession, and with this view he was for sometime occupied with the requisite exercises and accomplishments. The infirm state of his health, it would appear, obtained for him many indulgences, and when his father sent him to Paris, being left without controul, he was soon immersed in the pleasures and dissipation of that metropolis. By a fortunate meeting with some of his fellow students, and particularly with father Mersenne, he was persuaded to abandon his vicious courses; and with this resolution he secluded himself entirely from his former companions, and, during a retirement of two years, devoted himself to mathematical studies.

In the year 1617 Descartes entered as a volunteer in the Dutch army under prince Maurice, and in the solution of a mathematical problem, which was publickly proposed while he was at Breda, he obtained the acquaintance and friendship of the learned men of that country. In the succeeding year Descartes composed his *compend of music*, which first appeared at Utrecht in 1650, and, being translated into English, was published at London in 1653. Having spent some years in the Dutch and Bavarian armies, during which he was present at the famous battle of Prague and some other engagements, he returned to Holland and France, soon after visited Switzerland and Italy, and performed a pilgrimage to Loretto, the consequence of a vow which had its origin in a dream. Returning to Paris, Descartes, whose reputation as a philosopher was fully established, directed his pursuits not only to the theory but to the practice of optics. Some of the future years of his life were spent between France and Holland; he visited England in 1631, and made some observations on the variation of the magnetic needle in the vicinity of London. During his residence at Deventer, where Reneri, professor of philosophy, had embraced his opinions, he completed his *Treatise on the World*, and some of his optical works; but the persecution of Galileo discouraged him from publishing opinions which were likely to be the subject of keen controversy.

The publication of some of the metaphysical writings of Descartes which appeared anonymously at Leyden, involved him in much philosophical controversy, on what were then called the new opinions. These opinions were eagerly received in England, and indeed became the prevailing system of philosophy in many of the seminaries of the continent. But during the heat of these disputes, Descartes spent much of his time at Egmond in Holland, and devoted himself to the study of various branches of natural history and anatomy.

In the year 1649 he visited Stockholm, at the invitation of the celebrated Christina, queen of Sweden, and for the purpose of instructing her in the principles of his philosophy. But his illness and death in the beginning of the year 1650, when he had reached the 54th year of his age, disappointed the views of that munificent princess in retaining and establishing the philosopher in her kingdom. To honour his memory she proposed to consign his ashes, at the public expence, to the burying-place of the royal family, and to mark the spot by a splendid monument. The French ambassador declined the honour, conducted the funeral at his own expence, and deposited the mortal remains of his friend and countryman in the cemetery destined for foreigners. After the lapse of 17 years the ashes of Descartes were conveyed, at the expence of M. D'Alibert, treasurer-general of France, to Paris, and with great funeral pomp were interred in the church of St Genevieve du Mont, where a bust with an appropriate inscription was erected to his memory. A medal being struck in Holland a short time after his death, in commemoration of his splendid talents, shews in what estimation his character was held in that country.

The private character of Descartes seems to have been adorned with every amiable virtue. With the exception of his mathematical and optical investigations, and especially his valuable discoveries of the laws of refraction, which entitle him to a high rank among philosophers, his writings on natural philosophy and metaphysics are regarded as little else than ingenious speculations; and, in particular, his theory of the universe has long given place to the more solid discoveries and rigid demonstrations of the illustrious Newton.

DESIGN.

Introduction.

Painting and Sculpture.

The Arts of Design are those branches of the fine arts which, representing the forms and visible appearances of external nature, address themselves to the eye: They may be all comprehended under the following divisions; viz. Painting, Engraving, and Sculpture, to which we have added linear Perspective, which, though strictly speaking a branch of mathematics, is practically of use, and chiefly as an important auxiliary in the art of delineating objects.

Painting is the art of representing on a plane surface, by means of lines and colours, the appearance of visible objects, under the various circumstances of form, colour, and light and shadow.

This liberal art has always been honoured and respected according to the degrees of civilization and refinement to which society has arrived; it stands in the same rank as poetry, has the same object in view—the representation of nature, and, as far as the difference in their modes of operation permits, is conducted on the same principles. Thus painting, like poetry, comprehends the satirical, the comic, the pastoral, the didactic, the pathetic, the dramatic, and the heroic or grand style; and the rules of composition, of that kind more especially which relates to the representation of men and manners, extend equally to painting and poetry. The great object of both is to convey instruction, or to move the passions, by the representation of some fact, or appearance of nature, according to the end proposed. Thus in the pastoral, they delight and soothe by the appearance of a fine country; in satire, we see the deformities of vice, or, in her more sportive humours, the follies of mankind exposed and ridiculed; in the tragic, we are moved to pity or horror; and in the heroic, our enthusiasm is kindled by the representation of deeds of glory.

Arts of Design.

The ancients attached the highest importance to painting, and have recorded many instances of its moral effects and power, in moving the mind to pity, joy, remorse, or horror. Alexander trembled and grew pale on seeing a picture of Palamedes betrayed by his friends, by recalling to mind his treatment of Aristonicus; Portia, who had borne with the most heroic fortitude her separation from Brutus, burst into tears on seeing a picture of the parting of Hector and Andromache; and it is recorded of an Athenian courtezan, that, in the midst of a riotous banquet, casting her eyes on the picture of a philosopher which hung opposite, she was so much struck with the happy character of temperance and virtue, contrasted with her own unworthiness, that she retired home, and lived ever afterwards exemplary for the correctness and propriety of her conduct. Although these very striking moral effects of the art, related by ancient authors, are very questionable, and at least cannot be expected to occur to every votary of painting, yet its impressions are a source of great happiness to the individual, and are highly advantageous to society, in conducing to the refinement of the human mind; for "every argument of sorrow, every object of distress, renews the same soft vibrations, and quickens us to acts of humanity and benevolence," while our minds are likewise opened by it to the contemplation of the beauties of nature, and acquire a higher relish for every thing noble or sublime.

The following treatise is divided into four parts. I. History of the Arts of Design—II. Principles and Practice of those Arts—III. Engraving—IV. Perspective.

PART I. HISTORY OF THE ARTS OF DESIGN.

In the detail of the history of the arts of Design, to which this part is devoted, it may be convenient to divide the subject into two chapters, in the first of which the history of the Arts of Painting and Sculpture among various ancient nations, from their origin to their extinction during the decline of the Roman empire, will be considered, and some account of the different modes and processes adopted by them will be given; and, in the second chapter, the history of these arts, from their revival, about the middle of the 13th century, to the present time, will be treated of, and a view of the Italian, German, Dutch, Flemish, French, and British schools exhibited.

Chap. I. History of Painting and Sculpture, from their Origin to their Extinction during the Decline of the Roman Empire.

Although the arts of design minister more to the luxuries than the necessities of mankind, their origin must be placed at a very early period of the history of society; and, as the shadow cast by the sun, or the light of a lamp, might afford the first idea of a picture, and that of sculpture might have been suggested by the forming of household utensils of clay or baked earth, it cannot be doubted that they must have long preceded the use of letters, which could only have been the result of a complicated process of reasoning, when the human mind had arrived at a considerable state of improvement. Accordingly, we find most nations, even in a state of rudeness and barbarism, though totally destitute of letters, still cultivating, after their own manner, the arts of painting and sculpture, in the representations of their gods, and other subjects connected with their religious rites; while in the hieroglyphic sculptures of the Egyptians, and in the pictures of the Mexicans, we find those arts applied to the purposes of recording historical events, and communicating intelligence.

SECT. I. *History of Art among the earliest nations.*

Hebrews.—The Old Testament contains undoubtedly the earliest records on this subject; the images of Laban, and the signet of Judah, shew that even in the patriarchal ages the art of sculpture was not unknown; and the golden calf, the decorations of the tabernacle, and the ark of the covenant, executed by Bezaleel and Aholiab, at a later period, as mentioned in the book of Exodus, evince a considerable degree of advancement in the ornamental arts, and carry back their origin to a very remote period.

Babylonians, &c.—The arts amongst the Babylonnians, Persians, and other eastern nations, are but little known to us. It is, however, said by ancient authors, that the walls of the temple of Belus at Babylon were covered with grotesque figures, both in painting and sculpture, and that the interior was furnished with numerous ornaments in painting and sculpture, sacred vessels of different metals, and an image of gold. According to Diodorus Siculus, the external walls of the palace of Semiramis, which were of brick, were covered with representations of human figures and animals, as also of historical events, battles, hunting scenes, and the like; these seem to have been coloured on the brick before it was baked: the public buildings also were decorated with statues of gold, silver, and brass.

Persians.—Of the state of the arts among the Persians, with the exception of the scanty and vague information furnished by ancient writers, and the specimens brought from Persepolis, little is known. The remains of Persian art which have been brought to Europe, consist chiefly of works in marble and bronze, as well as gems. The ruins of Persepolis, while they display the riches and luxury of the Persian monarchy, give no very favourable idea of the state of the arts; the columns and other parts of the buildings are profusely covered with sculpture, conceived and executed without taste or elegance, but displaying a great degree of rude magnificence; they consist of various ornaments, figures fighting with griffins, and other fanciful animals.

The gems of Persia bear a strong resemblance to the early sculpture of the Greeks, and in specimens where the inscriptions are wanting they have been frequently mistaken for such; it has however been suspected, with great appearance of probability, that many of those remains that have been preserved to modern times are the work of Greeks who had settled in Persia after the Macedonian conquest.

Phœnicians.—The only remains of the arts of the Phœnicians or their colonies, are Carthaginian medals struck at Malta, Sicily, or Spain; and we are told by Winkelmann, that in the cabinet of the grand duke of Tuscany, at Florence, were ten medals of the city of Valentia, of exquisite workmanship, which could only be distinguished from the best Greek medals by the Punic inscriptions.

It cannot be doubted, however, that long before the Greeks had emerged from barbarism, the Phœnicians had established a widely extended commerce, and made many discoveries in those arts which minister to the comforts and the elegancies of life, and had also successfully cultivated the arts of design, a conjecture fully warranted by the medals which we have just mentioned. Among other arts, Sidon was celebrated for the manufacture of glass-ware, the fabrication of fine linen, working the metals, and carving in wood; and Tyre was famous for the dyeing of stuffs, particularly for the invention of purple, and for the beauty of its manufactures in ivory.

SECT. II. *History of Art among the Egyptians.*

But of all the ancient nations, as far as history affords any information, the Egyptians seem to have begun earliest to cultivate the arts, and to have brought them, notwithstanding the remarkable peculiarity of their taste, to a state of considerable perfection. The sculpture of the Egyptians seems to have been entirely devoted to sacred purposes, or to record historical events, and abounds in symbolical representations of the divine attributes and the personifications of abstract ideas, comprehending works of all dimensions, from the engraving of gems to the colossal statues of sixty feet in height, cut with incredible labour out of masses of granite. As early as the time of Sesostris, who is said to have flourished three centuries before the Trojan war, the Egyptians cultivated the arts, and erected many of those stupendous works, the remains of which are still the admiration of every beholder; among these were, according to Pliny, one of those obelisks which were brought from Egypt by Augustus, and set up in the Campus Martius at Rome, the vast edifices of Thebes, and many others. The remarkable peculiarities of their religious and civil institutions, were, however, eminently hostile to the developement of genius and mind; as their laws strictly prohibited all representations of the human form, except in images of their gods, their kings or royal persons, their priests, and the subjects connected with their religious rites; and so rigid was their adherence to ancient usage, that no change or innovation was permitted with regard to the attitude, figure, or attributes of the objects of their veneration. The sciences were also laid under the same restrictions; and even their physicians were prohibited from giving any other prescriptions than what their sacred books ordained. Thus the taste, imagination, and genius of the people were fettered, and each generation was obliged servilely to imitate its predecessor; and accordingly we are informed by Plato, that the statues executed in his time in Egypt differed little in form, conception, or character, from those that had been executed many centuries before. At what is called the Memnonium, are the two largest figures now remaining in Egypt. They are both perfectly alike, in a sitting position, their heads looking straight forward, both their hands lying equally on their knees, their feet straight forward, and their legs in an upright position. One of these, according to Diodorus Siculus and Strabo, was the famous statue of Memnon or Osymandues; but Denon and Ripand are of opinion, that the two remaining statues are the mother and son of Osymandues, and that the figure of this personage himself is lying among the fragments of granite with which the ground in this neighbourhood is covered; each of these figures is about 58 feet in height, and is accompanied by three of smaller dimensions, which have excited considerable admiration for the beauty and delicacy of their workmanship. The sphinx is another of the most celebrated colossal works of the Egyptians; its contours, according to Denon, are free and fine, the expression of the head is sweet, graceful, and tranquil; it has the character of the African; the mouth and lips are thick, but they possess an admirable softness in their movements, and a finesse and delicacy in their execution, which evince a high state of perfection in the art at the time in which it was executed. According to Ripaud, the length of the rock, to which the form of this chimerical animal has been given, is about 95 feet, and its height from the knees to the top of the head 38. The innumerable ruins, with which many parts of Egypt abound, display on all hands a prodigious quantity of sculpture in statues, relievos, besides capitals of columns, and other architectural ornaments, many of which, particularly of the architectural decorations, are conceived with much taste, and executed with great skill and ability.

The Egyptian statues almost invariably stand equally poised on both legs, the arms either hanging straight down or placed at right angles across the body; sometimes, however, they are in a sitting posture, either on seats or on the ground, sometimes kneeling, but the position of the hands never varies. Their female figures are frequently not destitute of elegance and beauty, and the heads bear a strong resemblance, in character, to the early sculpture of the Greeks, and, like it also, are destitute of variety of expression.

The sculpture of the Egyptians exhibits no trace of anatomical knowledge; and even in their figures in strong action the joints are not marked, nor is there any attempt to represent the more delicate and minute details of nature. But after the successors of Alexander the Great obtained possession of Egypt, the style of art received great improvement, by being combined and enlivened with some portion of the purity and correctness of the Greeks.

Notwithstanding the great uniformity of character of Egyptian art, some critics have imagined they perceived several modifications of style, indicating corresponding eras in its history; but as such disquisitions would be more curious than instructive, we shall refer those who would wish to inquire into this subject, to the dissertations of Winkelmann, and his annotators Fea and Heyne,—and to the works of Pococke, Norden, Denon, and other travellers who have visited that country. We shall only observe, that the general character of their style is stiff and spiritless. "Their attitudes," says a contemporary writer, "are, of course, simply rectilinear, and without lateral movement; their faces are flattish, the eyebrows, eyelids, and mouth formed of simple curves, slightly, but sharply marked, and with little expression; the general proportions are somewhat more than seven heads high; the form of the head and limbs rather round and effeminate, with only the most evident projections and hollows; their tunics, or other draperies are without folds in many instances.

"The Egyptian relievos are generally, but not always, sunk into the back-ground, being left level with the highest part of the relief; for which practice two reasons may be assigned,—first, that as many of those basso-relievos are cut in exceedingly hard stones, basalt and granite, as much time must have been consumed to clear away the ground about the figure as had been employed to cut the figure itself, besides the economy of time when some hundreds of thousands of figures were engraven on the sides of a lofty obelisk or the walls of a temple. The basso-relievos, which we comprehend under the general name of hieroglyphics, or sacred engravings, represent different subjects, according to the place and purpose for which they were employed. On the walls of tombs they represent the profession, and actions, and funeral of the deceased; in palaces, wars, negociations, triumphs, processions, trophies, with the civil, military, and domestic employments of the kings; in temples, they are symbolical registers of theology and sacred science; and on obelisks, they represent hymns to the gods, or the praises of their kings."

It has been said by some writers, that their representations of animals formed a striking exception; and the two lions at the Fontana Felice, the sphinxes on the obelisk of the Sun at Rome, and another at Dresden, are adduced as proofs of this observation; they are certainly conceived with much intelligence, have a fine, varied, and flowing contour, and are executed with spirit and elegance; but it has been conjectured, and with great probability, that they are only imitations of the Egyptian style, executed by Greek artists about the time of Adrian.

With regard to the Egyptian medals, it is uncertain whether any were struck before the time of Alexander the Great, although it has been asserted by some authors that they have been found in the mouths of mummies.

The substances employed by the Egyptians for their works in sculpture were, stone, such as granite, basalt, and marble,—bronze, clay, or *terra cotta*, and wood; those wrought, even in the hardest substances, are executed with the greatest care, and polished with incredible labour, probably by means of the corundum-stone, or adamantine spar. We are informed by Winkelmann, that of all the remains of Egyptian art which he had seen, he had met with one only which had been executed solely by the chissel, the only instrument with which the greater part of the finest Greek statues have been wrought. Their sculptures in wood are still occasionally discovered in the coffins of mummies, and are generally painted.

Of the painting of the Egyptians little is known; but from what we have said of its kindred art, sculpture, as practised among them, it obviously could not have attained any very high degree of perfection. It would appear to have been extensively applied to the purposes of both the external and internal decorations on their temples, palaces, and sepulchres; specimens of which are still to be found among the ruins with which that country abounds, and still retain, according to the report of travellers, a considerable portion of their freshness. Thus palaces are mentioned by Norden, in Upper Egypt, ornamented with columns thirty-two feet in circumference, which, as well as the walls, to the height of forty-five feet, were covered with paintings of colossal figures; and the sepulchres of Thebes, visited by Bruce, were also enriched in the same manner; and the coffins of the mummies are always found richly painted; the outline is drawn with a black paint on a white ground, and the colours filled in, side by side, pure and without mixture; they consist of six only, namely, white, black, blue, red, yellow, and green. These pigments seem to have been prepared in distemper with gum or other mucilage, and covered afterwards with a mordant or varnish, by which the colouring, as well as gilding, has been enabled to retain its freshness for so many ages.

For a more full account of the arts of the Egyptians, we refer the reader to the works of Herodotus, Diodorus Siculus, Josephus, Strabo, Clemens Alexandrinus, Jamblichus, and Orus Apollo, among the ancients; and to the works of the modern travellers, more particularly Pococke, Savary, Norden, and Denon.

SECT. III. *History of Art among the Etruscans.*

" The Etruscans now demand our attention. This wonderful people," says Mr Eustace, " equalled the Egyptians in the solidity, and surpassed them in the beauty of their edifices, excelled in the arts, and rioted in the luxuries of life, while the Greeks were still barbarians, and Rome had yet no name; and their antiquity is such, that their origin is lost in the obscurity of ages, and was even in the time of Herodotus, as it still now remains, a subject of dispute and conjecture. Some suppose them to have been aborigines, an appellation given to the inhabitants found in a country by its first recorded invaders; others, from a distant conformity of certain customs, fancy that they were of Egyptian origin. Many represent them as a colony of Lydians, or perhaps of Mœonians, compelled by the pressure of famine to leave their native soil, and seek for maintenance in a more fertile region; a still greater number imagine that they were Pelasgi, a well-known tribe of Greeks, who, when driven by the Hellenes from Thessalia, first took shelter in Lydia, and afterwards in Italy. In fine, a few later writers have thought that they had discovered in the manners, language, and monuments of the Etrurians and Cananeans, such an affinity as authorised them to conclude that the former were a colony of the latter, and of course either Phœnicians or Philistines."—" The Etrurians participated in the qualities of all the different nations to which they have been supposed to owe their origin; —brave as the Pelasgi, they extended their conquests over almost all Italy;—ingenious, like the Greeks, they cultivated sculpture, painting, architecture, and all the arts, with passion, and have left behind them numberless monuments to attest their success;—enterprising as the Phœnicians, they delighted and excelled in navigation, colonized the Mediterranean islands, and attempted to explore the secrets of the ocean." The Etrurians, in process of time, becoming enervated with luxury, and pressed by the valour of their neighbours, the Gauls, the Samnites, the Umbri, and the Romans, were successively despoiled of their finest territories, and ultimately, about the year A. C. 474, reduced to the condition of a Roman province.—" But although humbled in power, and reduced in territory," continues Mr Eustace, " this singular people still retained their superiority in the arts and in the embellishments of life; while obliged to bend to the towering genius of Rome, they can boast of having communicated to her the skill that erected her temples, the ceremonies that graced her religion, the robes that invested her magistrates, the pomp that accompanied her triumphs, and even the music that animated her legions; and they maintained this superiority long after."

The style of the Etruscan sculpture bears so close a resemblance to that of the early manner of the Greeks, that they cannot be easily distinguished from each other, except by some particular circumstance of, or known peculiarity in the costume or manner of representing the personages.

The Etruscans, however, in most of their productions, particularly in their works in bronze or in stone, marked their figures of the gods and heroes with their names,—a practice not in use during the flourishing ages of Grecian art.

The early style of Etruscan art is characterised by a stiffness and uniformity in the design of the figures; their legs are straight and parallel, and nearly close; the countenance destitute of beauty; and the head is oval, and much too large in proportion to the body; the chin is very pointed, and the anatomy of the muscles hardly marked. They afterwards fell into the opposite extreme, in giving a forced and affected variety to the attitudes and movements of their figures; their countenances were of an ordinary character, and without any traces of ideal beauty.

By their subsequent intercourse with the Greeks, the art acquired all the excellences of the style of that people, so that their later works are only to be distinguished from Greek sculpture by the place where they are found, or the Etruscan inscription with which they are marked.

It is remarkable, however, that even in the earliest times, when the representation of nature was so little understood among them, they had acquired a most admirable taste in the designing of their pottery, altars, vases, pateræ, and other vessels used in their sacred and funeral rites; and, to this day, numerous specimens of this department of Etruscan art are still found, by making excavations on the site of their cities, and from this source the public museums and cabinets of Europe have been amply supplied. Those precious reliques, in conjunction with the antiquities from Herculaneum and Pompeii, have had a decided influence in improving the taste of our household furniture and other internal decorations, and banishing the old French and Chinese styles from our dwellings and utensils.

The Etruscan pottery has often been imitated in modern times, and these imitations have been purchased as genuine by inexperienced travellers; but the deception may be easily detected by the extreme lightness of the originals compared with the imitations, no earth having been discovered in modern times in Italy of so very small specific gravity.

Sect. IV. *Among the Greeks.*

We come to the art among the Greeks, who, in grandeur and purity of conception,—truth, elegance, and grace in design, have never been equalled, and seem, indeed, to have carried to the utmost conceivable perfection the representation of the human form in its most elevated acceptation, and to whom the moderns are indebted for all that is excellent. It is certain, that as far back as the time of Homer, from the frequent allusions to it in his works, the arts must have been practised to a considerable extent, more particularly sculpture, as it is not well ascertained from any thing that early writers say on the subject that painting was then at all known; although, from Homer's description of the shield of Achilles, many authors have been of opinion that it was painted.

At a very early period, we find that there were three great schools of art in Greece, namely, at Ægina, Corinth, and Sicyon; that in these places it was extensively cultivated, from whence it disseminated itself over all Greece and the neighbouring countries.

Dædalus, the Athenian, is mentioned by ancient writers as the earliest sculptor on record, and is generally reckoned the patriarch of Grecian art; and it appears that, notwithstanding a coarseness of execution, his figures possessed an imposing aspect and considerable elevation of character. Pliny, Pausanias, and Diodorus Siculus, have enumerated several of his works, which seem to have been executed principally in wood; as late as the time of Pausanias, several statues by Dædalus were still extant, viz. a Hercules at Thebes, a Trophonius at Lebedos, besides several others of wood at Crete. He also executed several jointed figures, which moved by means of springs, and which gave rise to the fable of his making a man who performed all the functions of life. We next find the names of Smilis, the son of Euclid, of Ægina; and of Endœus, a disciple of Dædalus. After these came the artists of Rhodes, whose statues, executed in different parts of Greece, received the name of Telchinic, from the name of the ancient inhabitants of Rhodes. Gitiades, a Lacedemonian sculptor, who flourished in the ninth olympiad, (which coincides with the twelfth year after the building of Rome,) executed several statues in bronze at Sparta. About the eighteenth olympiad flourished Bularchus, a famous painter, who was paid for one of his works, representing a battle, with its weight in gold.

It would be attended with little advantage to enumerate the different artists of this early period whose names have been preserved; suffice it to say, that from the religious and civil institutions of Greece, the arts from their infancy were greatly cultivated; and as the highest honours and rewards were conferred on the artists, they went on improving till they had arrived, during the time of Pericles, to the highest perfection.

The destruction of Athens by the Persians, afforded to Themistocles ample scope for the gratification of his taste, by restoring the public edifices in a style of magnificence which had not been known before in Greece; but the administration of Pericles, a few years afterwards, forms the period of the highest excellence of Grecian art.

The impulse which the genius and taste of this great man gave to the arts is truly astonishing. The immense number of public buildings founded by him, in which the labours of the painter and sculptor were profusely employed, excited a general taste and feeling for the arts, while the encouragement that was given to artists, by the rewards and honours that were conferred on excellence, produced such a constellation of talent as no succeeding generation ever beheld. Pericles found in Phidias a person fully capable of carrying into effect his great projects, the superintendence of which was entirely committed to him, and executed by him and his disciples.

In order to convey some idea of the magnificence of the Athenian buildings erected at this time, we shall take a view of the temple of Minerva, called the Parthenon, in the Acropolis, a perspective representation of which will be found at Fig. 2. Plate 17. This sublime edifice, like all the temples of that period, was in the form of an oblong square, terminating at each end with a pediment; a peristyle, consisting of 58 columns, supporting an entablature of the Doric order, surrounded the whole. The tympanum at each end was decorated with colossal figures; the metopes of the external frieze consisted of figures representing the battle of the Centaurs and Lapithæ; the interior was also supported by columns, and the frieze of the cell contained in its whole circumference the representation of the processions of the Panathenaic games; these figures, as well as the external metopes, were upwards of five feet high each. The whole building was of white marble. Many interesting remains of these sculptures have recently been brought from Athens by the Earl of Elgin, and are now deposited in the British museum.

Besides the buildings which were executed under the direction of Phidias, he made many works in sculpture, for the temples of Athens as well as other places in Greece, the most celebrated of which were the statue of Minerva, for the temple of that goddess at Athens, and one of Jupiter Olympius, for his temple at Elis, both wrought in ivory and gold; the former of which contained the weight of forty talents of gold, of which the drapery was composed; the naked parts, the head, arms, and feet, were of ivory.

The principal disciples of Phidias were Alcamenes of Athens, and Agoracritus of Paos.

From this period to the time of Alexander the Great, we find the names of the following distinguished sculptors, worthy to be the successors of Phidias: Polycletes, Scopas, Praxiteles, Pythagoras, and Myron, the latter of whom is chiefly celebrated for his works in bronze. The painters at this period were Paninus, brother of Phidias, Euphranor, Zeuxis, Pamphilus, Nicias, and Parrhasius; according to ancient writers, these were the first painters who introduced colouring, and light and shadow, in their works. Under Alexander flourished

Lysippus, the sculptor, who is generally believed to have executed the famous horses of bronze which were placed on the gate of the church of St Mark at Venice, and Pyrgoteles, a famous *dactyliographer*, or engraver of gems; these two had the exclusive privilege of making the likeness of Alexander: The painters were, Apelles, (who was honoured with the same privilege as the two preceding sculptors,) Aristides, Protogenes, and Nicomachus. These are the names of the greatest celebrity, and we need not swell the list by repeating all those which have been preserved by Pliny and other ancient writers; suffice it to say, that the example of Pericles was followed by Alexander, in his love for the arts, which prolonged the existence of this golden age of art to a period of about 120 years, terminating at his death.

After the death of Alexander the Great, the unsuccessful struggles of the Athenians with his successors reduced Athens to the lowest degradation, and in this republic the arts became almost immediately extinct; and the other free cities of Greece being also humbled, and oppressed, and subsequently ruined and enslaved by domestic wars, in which even the monuments of art were not spared, the arts would have been entirely lost, had not Ptolemy Soter, who succeeded Alexander in Egypt, and the Seleucidæ in Syria, given encouragement to the Greek artists, by inviting them to their respective courts, and affording that patronage and protection which was no longer to be found in Greece.

As the Ptolemies were the richest and most powerful of all those who divided the conquests of Alexander, and as their love for the arts and sciences was not less than their means of encouraging them, every thing that tended to elevate or dignify the human mind was prosecuted with so much eagerness, that under the reign of Ptolemy Philadelphus, the second of the Greek kings of Egypt, the glories of Athens were revived in Alexandria, and philosophy and the arts again flourished in their new asylum.

In Sicily, from about this time to the taking of Syracuse by the Romans, the arts were greatly encouraged, particularly under Hiero, whose long, peaceful, and prosperous reign, by conferring wealth and happiness on the people, afforded leisure and inclination for the cultivation of every thing elegant and useful; we find that their temples and other public edifices were decorated with statues even of gold and silver, besides those of the usual materials; and Cicero informs us that the gates of the temple of Pallas at Syracuse were wrought and chiselled in gold and ivory, and surpassed all works of the kind. The principal works of this people that have come down to our times, are the silver medals of Syracuse, containing the head of Proserpine on one side, and the reverse a Victory placing a helmet on a trophy, the tasteful execution of which fully confirms what ancient writers have said as to the advanced state of the arts at that time; no mention is made of them after Sicily became a Roman province.

The kings of Pergamos, Attalus, and Eumenes, vied with the other successors of Alexander, in their love for the arts; and it is not well ascertained whether the famous library founded by Eumenes at Pergamos, or that at Alexandria, was the first established.

We shall now take a view of the state of arts in Greece, which began to revive for a short time, when its intestine dissensions were appeased, and the Macedonian kings were deprived of their authority, by Quintus Flaminius, which happened in the fourth year of the 145th olympiad, or 194 years before the Christian era. Pliny has recorded the names of Antheus, Callistratus, Policles, Athenæus, Callixenes, Pythocles, Pythias, and Timocles, all of whom he considers to be greatly inferior to their predecessors; this is held to be the last age of art in Greece.

The Romans having defeated Perseus, the last of the successors of Alexander in Macedon, and wishing to establish a superiority over Greece, became jealous of the Achaean League; this gave rise to the destruction of Corinth, and, with it, of the liberties of Greece, which at this period was reduced to the condition of a Roman province, about forty years after it had been declared free by Quintus Flaminius.

Corinth, as well as the rest of Greece, was pillaged by Lucius Mummius, the Roman general, of all its pictures, statues, and vases, which were carried to Rome. This seems to have been the beginning of the art at Rome; and, till this time, so little idea had the Romans of the nature of art, that Mummius is said to have charged the persons whom he employed to transport these works, to deliver them safe at their place of destination, under the penalty of *substituting others in their place.*

The number of the works of art thus carried away is incredible; and so insatiable was their desire for these works, or so great their love of destruction, that even whole walls which contained pictures, as at Sparta, were transported along with the rest. No consideration mollified the unrelenting hearts of these barbarians; the monuments of art which had been the admiration of ages, which were consecrated to the worship of gods, which recorded heroic deeds, or were dedicated to virtue or patriotism, were all swept away in this general system of plunder; and the arts from this time became extinct in Greece, no occasion presenting itself for the sculptor or architect, except in erecting statues to the victor in the Olympic games at Elis, which practice was continued as late as the reigns of the Emperors Valentinian, Valens, and Gratian, that is, till about the year 370 of the Christian era.

In Egypt and Asia the arts seem to have declined shortly after their being established. In Syria they expired with Antiochus Epiphanes. In Egypt they flourished under the three first Ptolemies, but rapidly declined under the tyranny of their successors.

The extreme simplicity of manners and warlike habits of the Romans, during the purest times of their republic, were highly unfavourable to the arts, which seem to have been totally neglected among them, till the influx of riches and luxury, by the wide extension of their empire, had relaxed much of the republican severity. This change was eagerly promoted by the ambition of many individuals, who having acquired great wealth by the plunder of the provinces, and aspiring to the sovereignty (under whatever name it might be called) of the state, endeavoured to dazzle and corrupt the people by magnificent pageants and splendid edifices.

Sylla on coming to the dictatorship patronised the arts most warmly, and his example was followed by Lepidus, Pompey, Verres, Julius Cæsar, and others, who formed collections of pictures, statues, and other works of art; and so rapidly did the taste improve, that, under Augustus, painting, sculpture, and architecture arrived at such a pitch of perfection as to form a second golden age of the art, almost to rival the times of Pericles and Alexander. But it does not appear that the Romans themselves made much proficiency in the practice of art, as most of the statues that have come down to our time are the work of Greek artists, many of whom were brought to Rome among the captives taken after the victories of Lucullus, Pompey, and Augustus.

The cruel tyranny under which Rome groaned in the time of the immediate successors of Augustus, brought on a premature and rapid decline of the arts, which the patronage of Adrian and the Antonines could only retard. Under their reigns, many magnificent works were executed in Italy and Greece, as well as in the provinces, which, however, exhibit strong proofs of the decay of taste; by the time of Septimius Severus it was almost extinct. It is unnecessary to prosecute the melancholy subject of the decline of art through all its stages; it will be sufficient to say, that the decay of morals and public spirit was powerfully seconded by the inroads of the barbarians, and arts and sciences were overwhelmed in one general ruin; and although long after the destruction of the western empire, in Constantinople luxury of every kind was indulged in to the greatest pitch, the Byzantine emperors had it not in their power to contribute a single statue to decorate their palaces or other public buildings without having recourse to the wretched expedient of dilapidating works of former ages.

In tracing the decline of the arts from the time of Pericles down to their extinction under the successors of the Antonines, we have followed the account given by the ancient writers, without giving implicit belief to the justice of their opinions.

Excepting the sculpture of the Parthenon which has recently been brought to this country, we believe that none of the finest works of the ancients are of the age of Pericles, but must be referred to a later era of the art, wherein, according to these writers, it was much on the decline; but how far this decay of art can be deduced from the Apollo Belvidere, the Venus de Medici, the groups of the Niobe and the Laocoon, and other fine examples of Grecian art, we cannot determine, but it appears to us to be at least greatly exaggerated.

Sect. V. *Character and Modes of Practice in the Arts of Design among the Ancients.*

Before proceeding to the history of the art from its revival in Europe in the 13th century, we shall take a brief view of the characteristics of the styles of the ancients, and the modes of practice adopted by them in the several branches of painting and sculpture.

The style of the ancient sculpture, (we speak of those examples which exhibit their excellencies in the most striking point of view,) is in general characterised by grace, simplicity, and beauty, with truth of nature more or less elevated by the ideal, according to the nature of the personage represented; and of this ideal we shall speak more particularly in the section on drawing and design.

Of all the monuments of art which have escaped the ravages of time, the Hercules of the Belvidere, commonly called the Torso, is the most sublime; uniting the greatest muscular strength in the trunk, with the greatest swiftness in the limbs; fitly representing the conqueror of Antæus, and the victor in the race at Olympia.

In the Hercules Farnese, which, from its analogy to the preceeding we shall next notice, the idea of great strength is finely expressed. Some critics have supposed that the thick and short form of the neck, as well as the character of the hair, are taken from the bull; and it must be allowed, that the ancients frequently adopted the characteristics of the lower animals in the representation of their human figures. Mr Barry gives the following very able and judicious criticism of these two statues: "When we reflect," says he, "on the various degrees and arrangements of bulk and heaviness that indicate an unfitness for action and agility, and the degrees of levity incompatible with strength, the Torso of the Belvidere will appear the most complete perfect system, or arrangement of parts, that can possibly be imagined for the idea of corporeal force which it was intended to represent. The character of all the parts most perfectly correspond with each other, and with the general idea; and if the length and taper form of the thighs are calculated to gain the victory in the foot race, yet their agility seems more the effect of force than lightness, and they are in perfect unison with the loins, abdomen, chest, and back. In comparison with this sublime vestige, the Hercules Farnese does not appear a stronger, though certainly a much heavier figure. It seems rather an idea of strength than of force, of mere stationary strength than active force, and has perhaps more of the Atlas than the Hercules, particularly from his loins down; but it is possible that a great part of what I least admire in the general appearance of this Farnesian Hercules may be owing to his legs, which are modern."

In the Torso, Hercules is in his deified state, having no veins; in the Farnese statue he is still in the midst of his labours, and subject to the wants of mortality, and his body is, therefore, according to the practice of the ancients, furnished with blood-vessels.

The Apollo Belvidere is, by some, considered equal to the Torso in sublimity and beauty. But the characters of the two personages are so different they do not admit of any close comparison. He is represented here as a tall and very beautiful youth, uniting as much strength as is consistent with activity, and the delicacy of the god of music, poetry, and painting; his countenance is full of dignity and expression, and his attitude is graceful and sublime; he has just transfixed the serpent Python with his arrows.

The groupe of the Laocoon, consisting of the father and two sons, with the serpents twisting round and crushing them, (the story taken from the Æneid) displays a scene of the most heart-rending and tragic nature. The expression of their countenances fully illustrates the agonies they suffer, which in the father are united to an elevation and dignity of character; the attitude and muscular action of every member indicates intense suffering. This groupe, in whatever direction it is viewed, exhibits the most interesting variety of contour. Mr Barry, speaking of the attention paid by the Greek artists to preserve beautiful and agreeably variegated forms in every aspect of their works, says: "When the highest possible of these mechanical attentions is thus worthily employed in decorating and giving the last perfection to beautiful or majestic form, and to interesting and sublime action, the mind is satisfied. We can then pursue with pleasure, even with enthusiasm, the skilful manner in which the sculptor of the Laocoon has obviated the disagreeable parallel appearances, and the void occasioned by the necessary action of the left arm: How usefully and agreeably is the chasm between the legs of the father filled up by the drapery, and by the noble contortions of the serpents, which bind the whole together, break it into agreeable angles, and give the necessary massive appearance which should predominate in this place."

The Fighting Gladiator, although necessarily destitute of the dignity and elevation of character which marks the Laocoon, or the ideal beauty of the Apollo Belvidere, or the Torso, gives the finest possible representation of the individual forms of vigorous manhood in powerful and energetic action, rendered with the greatest spirit and anatomical precision.

The Venus de Medici, is the finest model of the perfection of female form which remains; her countenance is full of celestial sweetness, totally free from the lasciviousness which has in modern times been given her; her attitude is easy, elegant, graceful, and dignified, though unassuming, and her form of the most exquisite symmetry and delicacy; she is just in the act of arising from the sea, and is without any other covering than the attitude of modesty.

The Antinöus of the Belvidere, as it is commonly called, represents youthful beauty and innocence of mind; the head is the finest of that class of character now extant; the arms and trunk are of exquisite beauty; but his lower extremities are in a style very inferior to the rest.

The Dancing Faun is a spirited and characteristic representation of these rural deities; here is none of the majesty of the Apollo, nor the elegance of the Antinöus, but both in the figure and countenance an expression of considerable vulgarity, highly appropriate to our ideas of them as conveyed by the poets; this is, however softened and refined, as might be expected in the works of a school of art which communicated a character of greatness to every thing it touched.

The sculpture of the ancients was executed in various substances, viz. marble, alabaster, porphyry, basalt, ivory, bronze, gold, silver, plaster, clay, and wood, to which we may add precious stones.

Marble was the material most frequently in use; and of it by far the greatest number of the statues which have come down to the present time is made. These statues were in general formed from one block of marble; however, it was not uncommon, even in the finest works, to execute the head separately, and to fit it afterwards to the trunk, as in the famous groupe of Niobe and her daughters, which stood in the gardens of the Medici.

It appears, from several unfinished remains, that it was the practice, as with the moderns, in blocking out the work to leave certain prominent points of the figure, which served as guides in copying from their model, and were cut away when the work was finished; after the figure was brought to a considerable perfection with the chissel, it was polished with pumice-stone and tripoli, and afterwards retouched with the chissel, in order to give more spirit to the execution of the more delicate parts.

It is, remarkable, that many of the finest Greek statues now extant, have been executed entirely with the tool, and without any polishing; and of this the groupe of the Laocoon is a striking example, exhibiting the great skill and dexterity of the artist in managing his instrument.

The white marble, in general, was obtained either from the Isle of Paros, or from Mount Penthele near Athens. Many works were likewise executed in black marble.

Alabaster was sometimes used, but it does not appear, from any ancient remains, that whole statues were made of it; on the contrary, it is highly probable that the heads, hands, and feet, were formed of some other substance, such as bronze, yellow marble, &c. In the male and bearded heads, the flesh is often finely polished, while the hair is left rough, which proves that this part was supplied in the manner above hinted at.

Basalt and porphyry were also employed, principally for busts and urns, and rarely for whole figures; what remains in that material is in general conceived in the finest style of art, and executed with the greatest care, which is very remarkable, as the labour was so great and the progress slow. The instrument made use of in working these substances, (which, from their great hardness, could not like marble be wrought with a large chissel,) was a very sharp and pointed tool, applied with the blows of the mallet; punches, with square points were next made use of, rasps and files, and it is probable that the corundum stone, or adamantine spar, in a state of powder, was employed to give the last polish to the work.

The urns of porphyry were in general richly ornamented with sculpture, being previously formed and hollowed out with incredible labour on the turning machine.

Ivory and gold in the making of statues, were much used even in the earliest ages of Greece; of these materials were the Jupiter of Phidias; the Minerva in the Parthenon at Athens, by the same; as well as many other statues in some of the most celebrated temples. Vases of silver, wrought with the chissel, were also fabricated at a very early time, and frequent allusion is made to them by the early critics, and as far back as the ninth olympiad statues of bronze were cast at Sparta. The bas reliefs in silver and in bronze, which seem to have been common about the time of Phidias, were called Toreutic works.

Wood, plaster, or stucco, was employed for the images of the gods worshipped by the poorer classes; the chief works in this material that have been preserved, were found in a bath near Naples.

In all ages of the art of sculpture, it has been usual to make models in clay of the intended work, whatever might be the material it was ultimately to be formed from; but, besides this use of clay, it was frequently applied to the purpose of *bas relief* sculpture, and which, when finished and properly baked like pottery, formed a very excellent and durable substance; numerous specimens of this species of ancient workmanship have been dug up in many parts of Italy, and principally from sepulchres. This substance has received from the Italians the name of *terra cotta*, or baked earth, a name which has been generally adopted.

Bronze is an alloy of copper and tin, the latter metal rendering it more fluid when in fusion, and more easily cast. It is evident that the early statues of this material were cast in separate pieces, and joined together with nails; and the famous horses of Lysippus at Venice are said, by those who have examined them, to have been cast each in two pieces, in the manner of a longitudinal section, and soldered together. In many ancient bronzes, the locks of hair and other appendages have been added and soldered to the figure. Many of these works were gilt, as the equestrian statue of Marcus Aurelius.

In many works of sculpture, the ancients adopted many practices which have been rejected by the moderns, as inconsistent with the nature of this branch of art; such as painting their statues according to the colours of nature, putting in the eyes with enamel, to imitate the appearance of the iris; sometimes also with silver; gilding the hair as in the Venus de Medici, and ornamenting them with bracelets, ear-rings, &c. of gold, silver, or precious stones.

The *Grecian medals* are, in general, very beautiful, and exhibiting the same taste as their other sculpture; many of those of bronze were plated, sometimes with silver or gold.

The cutting of precious stones was much in use among them; the substances most generally employed were carnelian, calcedony, agate, and onyx; or these were cut either in *cameo* (relief,) or *intaglio*, like seals, for making impressions on wax or any soft substance.

The tools made use of by the ancients for gem-cutting, we are told by Pliny, were small pieces of diamond fixed into steel; but it is not known whether they employed the wheel like the moderns, or only wrought with the hand. As the works are often very minute, it has been a subject of controversy, whether lenses or magnifying-glasses were known to the ancients, or by what means they could execute with so much accuracy objects so small. It is, however, asserted by M. Dutens, that there are many of those glasses in the cabinet of Portici, and of much greater magnifying power than have been ever used in modern times; and he mentions having one in his own possession, the focus of which was only four lines.

Although many specimens of ancient painting have been dug up in sepulchres, baths, and other places in Italy, and more especially in the temples and dwelling-houses of Herculaneum and Pompeii, yet as the style of design in general shews that they were the works of inferior painters, we can have no idea of those great works, the excellencies of which are so much celebrated by the writers of antiquity. We can have no doubt, that as drawing, or the representation of the human form, was carried to so great perfection, and as grace, elegance, and expression were so well understood by the Greek sculptors, that their paintings would, in this respect, not be deficient; and accordingly we find, that from the ornamenting of their pottery, up to the most finished paintings that have been preserved, their works are deeply imbued with that purity and elegance which distinguish all their productions; but it does not appear from any thing that has been preserved, that the ancients had any knowledge of the principles of colouring, or of chiar' oscuro, or the laws of perspective; so that we may reasonably conclude, that their works in this department of art, although possessing in some respects great excellence, were, considered as a whole, defective, and greatly inferior to what the moderns have produced.

Linear method of painting.—The earliest manner of painting among the Greeks was what is called the linear method, and was practised till the 94th olympiad, when the pencil or brush was invented by Apollodorus; it consisted of lines crossing each other in certain directions, in order to give the appearance of the shadows, in the manner of a stroke engraving. The first Greek paintings are the *skiagrams*, which were outlines representing the forms of objects as given by their shadows on a wall. The *monogram* seems to have been something of the same sort, with the addition of the parts within the outline which the shadow could not represent.

The *monochrom* had the addition of light and shadow, and was commonly executed by red lines on a black ground, or black ones on a red, and was employed by the Greeks, Romans, and Etruscans, in the ornaments of their pottery, as well as in the pictures which decorated the insides of their houses and sepulchres.

The details of the linear method, as practised by the ancients, are involved in great obscurity; it appears, however, from Pliny, that the first preparation was a mixture of Punic-wax, and of the colour which was to form the lights of the picture, whether yellow, red, &c.; this coat was of considerable depth; the next was a coat of deep brown, black, or some dark colour, also mixed with the wax, but of no great depth: when this was dry, they traced, with a sharp-pointed instrument, called the *cestrum*, the outline of the proposed design, and the lights were then brought out by scraping off the dark ground; thus making the first preparation appear. The tools were either of wood or steel, sharpened at the point, according to the fineness of the line required; and the work, if carefully done, seems to have been susceptible of considerable beauty, if we may judge from the immense sums that have been paid for them, according to ancient writers, and must have had a great resemblance to a chiar 'oscuro engraving. Very few of these pictures in the linear manner have been preserved to our times; and we do not know that more than four of them have as yet been found at Herculaneum.

The paintings in colours, or *polychroms*, were executed on the walls in fresco, or while the plaster was wet, and sometimes on wood or marble.

Some of the most famous paintings of antiquity, were executed with only four colours, namely, white, red, yellow, and black, as the works of Zeuxis.

This subject of the painting of the ancients has engaged the attention of many learned antiquaries; the inquiries, however, we are convinced, will not be attended with any great practical advantage, as the discoveries of modern times, both as to the principles of conducting a picture, and the materials and processes with which it is executed, have given a perfection to the art of painting, totally unknown to the ancients.

The *polychrom* was executed in all the colours then known, the pigments being mixed with gum or wax, and laid on with brushes, except in fresco painting,—the process by which it was performed, we have mentioned in another part of this Treatise.

Another method, frequently mentioned by the ancient writers, called *encaustic*, has been entirely lost, and has been the source of much controversy among writers on the subject. It has been generally considered to consist of the mixture of wax with the colours, which were applied by means of fire, or inustion, from whence it derives its name; others think, that every pigment, composed of pitch, or oleaginous matter, which, from being soft, or capable of being melted, became hard or dry, and indissoluble, was called encaustic; but nothing of the process is known to a certainty. It was much used by the ancients in their pictures.

Mosaic was a mode of making paintings, performed, not by the application of pigments, but by cementing small pieces of stone or of glass of different colours, so as to give the appearance of pictures. It was commonly employed in decorating the pavement, cielings, or walls of temples and palaces. The most common mosaics consisted of black and white stones, cut square. The mosaics of glass-paste were rich and of various bright colours. This art has been occasionally practised in modern times, as in the interior of the cupola of St Peter's at Rome. The subjects that were most usual in this art were grotesque ornaments, in which human figures were introduced.

The coins and medals of the ancients, from the beauty and taste displayed in their design and execution, are, to the artist and intelligent connoisseur, objects of peculiar interest; while, to the historian, classical scholar, and antiquary, they have been no less useful in illustrating many points in the history, mythology, and manners of those interesting ages.

The ancients were no less attentive to the beauty of their medals and coins, than to the other branches of the fine arts. Their ideal heads are conceived and executed with the greatest taste; and in the portraits of individuals, they paid the utmost attention to the accuracy of the likeness, so that they have often served to explain the subjects of statues, and other pieces of ancient sculpture, which would have been otherwise totally unknown. Till after the age of the Antonines, that is to say, as long as the fine arts continued to be cultivated, the heads of the Roman emperors were executed with the greatest accuracy, in point of resemblance; so that in whatever province the medals of any emperor were struck, they were all perfectly alike.

The medals of the ancients, for beauty of execution and fidelity of individual representation, exhibit a remarkable contrast with the greatest part of the coins of modern times, and particularly of our own country, which, in point of taste and design, are greatly deficient, while the effigies of his Majesty are so totally different on the various coins, that one cannot imagine it had been attempted to represent on them the same individual.

Chap. II. History of the Revival of the Arts.

The fine arts, which we have seen decline rapidly after the death of Augustus Cæsar, and become totally extinct about the time of Constantine, did not revive till, after many ages of barbarism and ignorance, about the middle of the 13th century, Cimabue, a native of Florence, began his career as a painter, and introduced some improvement in the wretched style that was then practised. Till this time, the only employment that was afforded to the painter was derived chiefly from the piety or superstition of the people, and consisted in making pictures of saints and similar subjects, and painting images used in divine worship. The art was held in no estimation, and the artist himself considered in the same rank as the mechanic or labourer.

Sect. I. *From the revival of the Art, to the end of the 15th century.*

Although Cimabue is generally reckoned the first who revived the art in Europe, it is certain that it had been practised in Italy by Greek artists for two centuries before; their works are, however, without light and shadow; the drawing is in the most barbarous style, and the whole inferior even to the kings and queens on a pack of cards. The works of Cimabue, as may be expected in one who was groping in the dark, and without guides to conduct him in the right path, were rude and gothic in their manner; yet they were so much superior to any thing that had been seen before, that he acquired great reputation and honour, and it is even related that, on finishing his picture of the Madonna, for the church of Santa Maria Novella, it was carried in triumphal procession, with the sound of trumpets, to its place of destination. In this picture, which is still extant, " all the parts of the body are very much confounded together; and though dry and meagre, they are, particularly in their flexures, as inartificially drawn as if copied from the bendings of a sandbag; the drawing of the face of the Madonna is very defective; the angels that are kneeling round her are in good proportion; and there is actual merit," as Mr Barry says, " in many parts of it."

Giotto, the disciple of Cimabue, improved much the style of his master, in avoiding the stiffness and formality which marked his works; his design has more correctness and symmetry; there is more expression in his heads, and he was the first painter

Revival.

who gave to portraits an air of truth and resemblance. He died in the year 1336.

The art was a little improved by the disciples of Giotto; but it was only with Bruneleschi, Lorenzo Ghiberti, Andrea Mantegna, and Masaccio, (the latter of whom was born in Tuscany in the year 1417,) that the true principles of art were introduced, and the foundation laid of the great excellence to which it subsequently attained in the Roman and Florentine schools.

Bruneleschi's style displays more enlarged views of art than appear in the school of Giotto; having studied the antique, his attitudes are good; his heads are of a good character; the drawing is correct, and the anatomy is well understood.

Lorenzo Ghiberti, in his early works, was stiff and dry, but in his later productions he displayed much beauty, elegance, and grandeur; his drawing of the naked is perfect, and his knowledge of perspective is profound. He was the first who emancipated himself from the gothic stiffness which prevailed at that time. It has generally been considered that Michael Angelo drew, in a great measure, his grand style of composition from the works of Ghiberti, to which, in many points, they bear a very great resemblance; his principal works are in sculpture, as the gates of the Baptisterium and Or San Michele at Florence; they are executed in relievo in bronze.

Andrea Mantegna, from the study of the antique statues which his preceptor, Squarcione, had procured from Greece, acquired great elegance and purity of design, fine choice of forms, and a simplicity of composition; his most celebrated performance in oil is his picture called *della Vittoria*, painted in 1495, for a chapel of the Marchese Francesco Gonzaga, in the church of the Filippini, in commemoration of a victory gained by that prince over Charles VIII. of France, at the battle of Formoni. It represents the marquis in armour, kneeling before the virgin and infant, seated on a throne, surrounded by several saints. In this extraordinary production, the surprising delicacy of the carnations, the elegant cast of the draperies, the glittering lucidity of the armour, and the tasteful accessaries by which it is accompanied, equally surprise and charm. Each head is a model worthy of study, for grace and vivacity of expression, and truth of character.

Masaccio formed his principles on the study of the works of Lorenzo Ghiberti; his best productions exhibit a greatness of style unknown to his contemporaries; his design is daring, though correct; his colouring tender and true, with a harmony of effect little known at that time; his heads are remarkable for truth of expression and animation. His works became the study of the best painters of the time; and even Raffaele himself is indebted to Masaccio for a great part of the excellency of his best works. He died in the prime of life in the year 1443, and is suspected to have been poisoned.

To the new lights which Masaccio threw upon the art, Leonardo da Vinci added the effect of the passions on the countenance, and the motions and gestures of the body: In the stronger expressions he stands altogether unrivalled; his design is vigorous and full of character; his colouring is mellow and deep-toned; and there is no doubt that Georgione, Titian, and the rest of the Venetian school, derived the characteristic beauty of their colouring from the contemplation of his works. Many of the pictures of Leonardo da Vinci would be mistaken for the works of Georgione, from their exquisite colouring, were this not contradicted by their great superiority over the Venetian masters in drawing, expression, and character. This profound and scientific artist was thus the first who united in his works all the parts of painting in an eminent degree, viz. in what relates to form, chiar' oscuro, and colouring, in each of which he far excelled all his predecessors and contemporaries. He has left behind him a treatise on painting, replete with information, and containing the soundest views of the subject, and a treatise on anatomy, accompanied with drawings by himself, the manuscript of which is preserved in his Majesty's library; of this curious relique, without doubt the oldest treatise on the subject, a part (and we believe no more) was published, with engravings in imitation of the originals by Bartolozzi. This great man was also a mathematician, engineer, chemist, musician, sculptor, and architect, and was one of the most elegant and accomplished men of his time.

Arts of Design.

SECT. II. *From the beginning of the 16th century to the decline of the Arts in Italy.*

Michael Angelo Buonarotti, a pupil of Ghirlandais, possessed the highest sublimity of conception, and the greatest skill in the grouping and composing of his figures; his drawing of the naked is vigorous, intelligent, and correct, and displays the most intimate knowledge of the anatomy of the human body. His admiration of the Torso of the Belvidere, led him to adopt the grand style in which it is executed, even in characters for which it was by no means appropriate; in his great work of the Last Judgment, in particular, this character prevails through the whole picture.—" The poetry of the art," says Sir Joshua Reynolds, " he possessed in the most eminent degree; and the same daring spirit which first urged him to explore the unknown regions of the imagination, impelled him forward in his career beyond those limits which his followers, destitute of the same incentives, had not strength to pass. He was the bright luminary from whom painting has borrowed a new lustre, under whose hands it assumed a new appearance, and became another and superior art."

Michael Angelo, although he painted many sublime pictures, must rather be considered as a sculptor, as sculpture was the art to which he principally dedicated himself; and as it was only in those parts of the art which relate to form, and are common both to painting and sculpture, that he directed his attention, chiar' oscuro and colouring are not to be sought in his pictures. From this time the Roman and Florentine schools, following the example of Michael Angelo, neglected colouring and chiar' oscuro, and aimed only at greatness in character, expression, and drawing.

Raffaelle, a disciple of Pietro Perugino, was in his early works dry and hard, with somewhat of the gothic stiffness of manner; however, on studying the works of Masaccio, Michael Angelo, and Leonardo da Vinci, he greatly enlarged his style; the predominant excellence of Raffaelle's works is truth and propriety of character and expression, both in his heads and in the drawing, attitudes, and choice of his figures. He never attained to the sublimity of Michael Angelo, nor the grace and ideal beauty of the antique statues; he therefore exhibits only the finest elevation of the human character, brought together and disposed, along with the necessary episodes and other minor circumstances, in a manner the fittest and most appropriate for relating the story. Although there is no part of the art in which he has, perhaps, not been excelled, no one has ever combined so many excellencies, and in so eminent a degree. The large works of Raffaelle are decidedly the best, as in his easel pictures the dry style of Perugino is still perceptible.

Corregio, born 1494, in the duchy of Modena, is the father of grace and chiar' oscuro; little is known of his history, and the notices we have of him are contradictory and uncertain. His style was not derived from any other painter, being totally different from any thing that had been produced before, and it does not appear that he had ever seen the works of the great masters of the schools of Rome and Florence, his contemporaries. Instead of the bold and energetic manner of those masters, he exhibits the most exquisite grace and sensibility; his colouring, joined to the effect, breadth, and clearness of his chiar' oscuro, is harmonious and enchanting. In his search after grace he avoided all angular turnings, in his contours seeking contrast and variety; and in this he is in general eminently successful, although it is sometimes carried to the other extreme, that of affectation and inaccuracy. His principal works are, the dome of the cathedral at Parma, and that of the church of the Benedictines at the same place, painted in fresco, besides many exquisite paintings in oil, the chief of which is the celebrated *Notte*, or picture of the nativity in the gallery at Dresden.

Francesco Mazzuoli, called Il Parmeggiano, was born at Parma in the year 1504. He first formed his style on that of Corregio, but after visiting Rome, he added, to the grace and sweetness of that master, the strength and energy of the great masters of the Roman and Florentine schools. His forms and attitudes are beautiful, and are frequently an improvement on those of Corregio; but his design is in general more tasteful than correct. The airs of his heads are highly expressive, though frequently bordering on affectation, and in aiming at delicacy and sweetness he often lost sight of truth of nature and simplicity; his colouring is very fine, and he was a most intelligent master of the chiar' oscuro.

At this time the Venetians brought the principles of colouring to the highest perfection; and as this was almost the only object of their attention, they display little of that greatness of manner or powerful expression which characterises the Roman and Florentine schools, or of the ideal beauty of the antique. At the head of this school we must place Georgione and Titian, both disciples of Bellini. The colouring of Titian is warm, powerful, and richly varied, and his chiar' oscuro well managed; his drawing is sufficiently correct, but deficient in grandeur; in his historical subjects, the heads are destitute of expression of passion, and the gaudiness of his draperies and other parts of costume, by the introduction of rich stuffs, deprives his works of the severity of style which in many cases should be more appropriate. These defects are not peculiar to Titian, but are chargeable to Paul Veronese and all the masters of that school. Portrait painting was also practised by the Venetians to a great extent, and was carried by them, particularly by Titian, to a pitch of perfection that has never been equalled since. Titian was also a most admirable painter of landscape; his compositions are magnificent, and possessed of a fine classical feeling.

The four great parts of the art were now brought to perfection in the different schools of Italy where they were respectively studied; and although the disciples of those great masters whom we have already taken notice of, threw no new light on the art, yet the principles of sound design were ably maintained by the successors of Michael Angelo and Raffaelle, namely by Giuglio Romano, Polidoro da Caravaggio, Perino del Vaga, Baroccio, Andrea del Sarto, Il Pontormo, Daniele da Volterra, and others. The grace of Corregio was happily attained by Parmeggiano, and in a manner sometimes surpassing him by Schidone, Baroccio, and others; while the principles of colouring which were brought to perfection by Georgione and Titian, appeared in the greatest splendour in the works of Paolo Veronese, Tintoretto, Pordenone, the two Palmas, and others of the Venetian school.

The three Caracci, Ludovico, Agostino, and Annibale, who founded what is called the Bolognese school, introduced the union of all the parts of painting, which had been, as we have seen, hitherto cultivated separately by the different schools; and although in no part have they equalled the excellencies of the best masters, yet their works exhibit such a happy combination of fine composition, drawing, chiar' oscuro, and colouring, as had never been witnessed before, and has ever since been the model of style for historical painting. It is to be regretted that, in their colouring, they adopted the style of Corregio instead of that of Titian. Annibale painted landscape in a style of great excellence, in which he united grandeur and elegance of composition, fine colouring, and effect, and their beauty was still more enhanced by the historical subjects with which they were adorned. Agostino dedicated a great part of his time to engraving, and has executed a very great number of plates, both from his compositions and from the pictures of others, which shew him to have been one of the best engravers of his time. Had he dedicated himself wholly to painting, and had Annibale not been cut off by a premature death, we have reason to believe that their genius would have carried the art to a much higher pitch of perfection, and that the reputation of the school of the Caracci, high as it is, would have been raised much higher.

Michel Angelo Amerigi, called Caravaggio, born at Caravaggio in the Milanese, in the year 1569, at this time introduced a new manner, which threatened to undermine the foundations of legitimate art, and had a decided influence for a time on the taste of the public, as well as of the artists his contemporaries, many of whom were led to forsake their own manner, and suffered themselves to be carried away by the current of public opinion. The great excellence of Caravaggio is the vigour and force of his pencil, the richness and beauty of his colouring, and the intelligent manner in which his chiar 'oscuro is conducted, and in which he so powerfully contrasted his lights and shadows; he had a very slender foundation of drawing, and accordingly generally selected such subjects as admitted of figures only in half length, and where the delineation of the naked was not required; he is totally destitute of grace and elevation of character, his figures are therefore correct transcripts of the models, undignified by sentiment, and unrefined by the ideal beauty of the antique. He died at Rome in 1609, aged 40.

The most eminent of the disciples of the Caracci were, Dominichino, Guido, and Albano. Dominichino for expression stands next to Raffaelle; his design is pure and grand, elegant and correct, his heads are full of grace and beauty, his compositions are studied and appropriate, and his forms well chosen, and impressed each with its proper character; his landscapes are in a style of much grandeur, and possess a great deal of the character of those of Annibale Caracci.

The first manner of Guido Rheni was in imitation of the powerful and impassioned style of Michael Angelo Caravaggio, which, however, was destitute of grace, and without fine selection of nature; he next adopted a more flowing and graceful style of design, perfectly opposite to that of Caravaggio; the airs of his heads of this time are exquisite as to tenderness and sweetness of expression, rather than from regularity of feature. In his Madonnas, and other female personages, the lovely and modest expression of the eye, and the tenderness, delicacy, and pathetic character of the whole countenance, stand altogether unrivalled. Guido, in his later years, became addicted to play, by which he ruined his fortune and lost the enthusiasm for the art which distinguished him, while the embarrassments in which he involved himself, and his consequent necessities, led him to execute his works in a careless and slovenly manner, without study or labour, and these display only the dexterity of a practised hand, without the mind which should guide and direct it.

The genius of Albano was not of that powerful character which we have noticed in Dominichino and Guido. The interesting beauty of the female and infantine forms, the nymphs, the graces, and the loves, were the subjects on which he exercised his pencil. In these he has displayed the greatest elegance, grace, and propriety of form and attitude, joined to a most beautiful tone of colouring. In his male figures, there is a want of the necessary vigour and energy of character and action.

The works of Guercino exhibit three different styles, which he adopted at different periods of his life. He is usually classed with the Bolognese masters, though from the date of his birth, 1590, he was certainly not a disciple of the Caracci, as asserted by some authors. In his first manner he seems to have been, like Guido, led by the admiration which the style of Caravaggio excited at that time, into an imitation of the violent opposition of light and shadow of that master; and though his works of this time savour strongly of his false taste and coarseness of character, he always excels him in correctness of design and dignity of expression. His second style displays more grandeur and elevation of character, more delicacy of colouring, a better taste in his heads, and a fine breadth of effect. In his third manner, in aiming at the grace and sensibility of Guido, he lost the vigour and energy which distinguish his best works. "It must, however, be allowed," says Mr Bryan, "that in his best works we look in vain for the graces of ideal beauty, or the purest choice of the antique; his figures are neither distinguished by dignity of form nor nobleness of air, and there is generally something to be wished for in the expression of his heads: but he subdues us by the vigour of his colouring." From the astonishing number of his works, his facility must have been unparallelled; he likewise painted in fresco, which he carried to great perfection.

Among the foreigners who studied in Italy about this time, and adopted the taste of the Roman school, Niccolo Poussin stands pre-eminent. The works of Raffaelle and the antique sculptures were the great objects of Poussin's study and admiration, and their spirit he has most successfully infused into his pictures. They display a remarkable purity of taste, simplicity, and grandeur of composition, and a fine classical feeling; his forms and attitudes are dignified and majestic, his groupes finely arranged, and his design chaste and correct. His historical works are richly embellished with suitable accompaniments of landscape and architecture, departments of art in which he was eminently excellent, and the whole evinces great erudition and a profound knowledge in the theory of his art. There is, however, frequently a want of the variety of character so conspicuous in the works of Raffaele, and his colouring, which he neglected, is in general bad. The greater number of his works consists of historical subjects of a small size; but he also painted landscape in a very great style of composition which is justly admired.

From this time the art began to decline, as, in the pursuit of novelty, its professors lost sight of its genuine principles; and, accordingly, no painter of any remarkable excellence appeared to arrest the progress of its decline, which seemed to keep pace in Italy with that of the papal power. We must, however, acknowledge, that although no considerable historical works were executed in Italy, if we except perhaps those of Carlo Maratti, who is significantly called "*the last of the Romans*," yet much taste and talent were displayed, on a smaller scale, in the fancy subjects of Andrea Sacchi, Benedetto Castiglione, and Filippo Lauri; that great truth of nature and elegance of conception were exhibited in the landscapes of Claude Lorraine, Swanevelt, and Gaspar Poussin; and that both in the historical compositions and landscapes of Salvator Rosa, the rugged character of savage nature have been exhibited with great truth and energy, though certainly without the elegance, purity, and correctness of drawing which are so characteristic of the better times of the art.

Sect. III. *Different Schools.*

We have thus taken a view of the progress of the art from its revival to its decline in Italy, in the order in which its several parts were brought to perfection, rather than by giving the history of each school separately; we shall now briefly recapitulate according to this latter arrangement, and also make a few observations on the German, Dutch, Flemish, and French schools, which have each in its way produced works of great excellence, and in various departments of the art.

Florentine.---We have seen then that at Florence, Cimabue, who died about the year 1300, and his disciple Giotto, who died in 1336, were the first to raise the art from the state of barbarity in which it had remained for so many centuries; that Filippo Bruneleschi, by the study of the antique, gave more grace and vigour to his figures; and that L. Ghiberti, in his bronze works, notwithstanding a certain dryness in his composition, laid the foundation of the grand style which was afterwards perfected by Michael Angelo; Masaccio, to a great style of design, added truth of colouring and harmony of effect; and Leonardo da Vinci, to excellence in all these, gave powerful expression in his heads and the attitudes of his figures. Michael Angelo in his works, both in painting and sculpture, gave the highest sublimity of composition, joined to the finest drawing, and the most profound anatomical skill. After his example, the Florentines attached themselves solely to composition and design. The character of this school is a noble, great, and correct style of design, more vigorous, however, than graceful, as the study of the antique was but little cultivated among them.

Roman.—The Roman school, the offspring of that of Florence, from whence it derived its fine design, exhibits an admirable taste and elegance of conception, vigorous imagination, chastened and subdued by the study of the antique, and the finest choice of expression; but colouring was little attended to. Raffaelle is the head of this school, and had many disciples of great eminence, the chief of whom is Guiglio Romano.

Lombard.—The Lombard school founded its taste on design in the finest choice in nature, but without the study of the antique; it exhibits a tender and interesting grace, flowing colours, an exquisite chiar' oscuro, and good colouring. Andrea Mantegna was its founder, and its principles were brought to perfection by Corregio, a contemporary of Raffaelle and Michael Angelo.

Venetian.—The most scientific and brilliant style of colouring, a faithful imitation of nature, a vigorous and elegant touch, form the most striking characteristics of the Venetian school; but as it attached itself solely to what related to colouring, its design partakes not of the ideal beauty of the antique, though well enough rendered as to the forms of common nature. Gentile Bellini, who died in the year 1501, was the founder of this school, and his principles were brought to perfection by Georgione and Titian; it must, however, be observed, that their great excellence in colouring is to be ascribed to the study of the works of L. da Vinci, who was the actual discoverer of the fine manner of relievo and colouring which distinguishes this school.

Bolognese.—The Caracci, the founders of the Bolognese school, endeavoured to combine all the parts of painting, and their success we have already taken notice of.

French.—In France the arts seem to have been little cultivated before the time of Francis I. who having invited L. da Vinci, Primaticcio, and other Italians, disseminated a taste, which was promoted by the erection of a school of painting by Simon Vouet; but although this country has produced many artists of eminence, we find much difficulty in assigning to the French school any decided characteristics, as their painters in general followed the manner of the schools where they studied. The most eminent of their historical painters are N. Poussin, S. Bourdon, Le Brun, and Le Sueur, all disciples of Simon Vouet; but as their style of design is entirely Roman, in which school they completed their studies, and, with the exceptionof Poussin, with indeed a better tone of colouring in their works, we cannot withhold her claims of ranking them amongst her sons. During the reign of Louis XIV. many great works were executed in fresco, &c. in the palaces and public edifices of France, by the Coypels, Mignard, Jouvenet, de Moine, and others, in which the purity and sound principles of the Roman style are sacrificed to the gaudy frivolity of the national taste, which was often carried to the greatest pitch of absurdity and extravagance by the Vanloos and Boucher.

In portrait-painting, which was much cultivated amongst them, their colouring was frequently good, and the character well expressed; but in the accessory parts, draperies, &c. the national taste was predominant.

In the works of Greuze, who exercised his pencil on conversational and other familiar subjects, and pathetic scenes of domestic distress, the colouring is exquisite, and his effect broad and clear. In the gallant subjects of Watteau, we find the most admirable management of colour, and light and shadow, which only an inspection of his works can give any idea of,—while his skill in the introduction of his reflected lights, joined to a spirited style of handling, give a vigour and force to his works only to be found in some of the best productions of the Dutch school.

"The genius of Watteau," says Walpole, "resembled that of his countryman D'Urfê; the one drew, and the other wrote, of imaginary nymphs and swains, and described a kind of impossible pastoral, a rural life led by those opposites of rural simplicity, people of fashion and rank. Watteau's shepherdesses, nay his sheep, are coquets; yet he avoided the glare and *clinquant* of his countrymen; and though he fell short of the dignified grace of the Italians, there is an easy air in his figures, and that more familiar species of the graceful which we call genteel."

Since the revolution, the arts in France have undergone a total change; instead of their former bombast and flutter, we find cold, dry, and lifeless imitations of the antique statues, drawn, it is true, with care and correctness, but without motion or energy, and in a style of colouring which could only be expected from those who had never heard of Titian, Corregio, or Rubens.

The Flemish school, under which name we may class the German, the Flemish properly so called, and the Dutch, comprehends many different styles of art.

German, &c.---The first manner of oil-painting of the German school was gothic and barbarous. Quintin Matsys, denominated the blacksmith of Antwerp, is amongst the earliest masters of this school whose works have been preserved; his style is dry, laboured, and minute; but his colouring is good, and his heads are often in character not inferior to Raffaelle.

Jerome Bos or Bosche, born about 1470, chose subjects which are commonly grotesque representations of spectres, devils, and incantations, and which, notwithstanding the eccentricity of style, exhibit much ingenuity; he likewise engraved many of those subjects in the stiff gothic style which was practised at this time. These are much sought after by the curious.

Albert Durer, a disciple of M. Wolgemeth, was the first who endeavoured to reform the taste of his countrymen from its primitive rudeness; but of the style that preceded him little is known, as, of the works of a date prior to this, few specimens remain. His pictures display a fertile invention, a design more precise than graceful, fine colouring, and high finishing; his forms are, however, without selection, and his characters destitute of dignity. His knowledge of anatomy was profound; and we may safely conclude, that if he had had the advantage of studying the antique, and seeing the works of his contemporaries at Rome and Florence, the vigour of his genius would have enabled him to rival the most esteemed productions of the Italian masters; as an engraver he stands high, and his works are much esteemed for the beauty of his execution, notwithstanding the defects of their composition.

Contemporary with Albert Durer is Lucas Jacobs, commonly called Van Leyden, from the place where he resided. His works consist of history, portraits, and landscapes, in oil, distemper, and on glass; his colouring is fresh and clear, and his pencil light, though finished; his drawing is stiff, ungraceful, and inelegant, like all the works of this time in Germany and Flanders. His engravings, which are numerous, are much esteemed. There subsisted between him and Albert Durer the warmest friendship; his works bear a strong resemblance to those of Albert, whom, however, he excelled in composition, although he is inferior to him in design.

Hans Holbein was born at Augsburg in 1498; he painted history and portrait, but principally the latter. With the exception of the dry manner of his draperies, he had little of the defects of the German school; his imagination is elevated, his colouring vigorous, and he had a delightful style of relievo in his figures. During a long stay in England, he painted the portraits of Henry the Eighth and most of the English nobility, which, for powerful expression and character, and true and simple design, have seldom been equalled; his carnations are tender and clear, and his heads, without much shadow, have a surprising relief.

From this time the taste of the German school began to receive great improvement, both in painting and architecture, from many of its artists visiting Italy, who, by adopting the styles of the great masters of that country, introduced a more pure design, and a more dignified and graceful composition, so that the gothic manner gradually disappeared.

This favourable change is very obvious in the works of Bernard Van Orley, Arnold Claessoon, Lambert Lombard, Francis Floris, Joas and Henry Van Cleef.

Flemish.--Bartholomew Sprangher, born at Antwerp in 1546, in improving (as he thought) on the grand style of Michael Angelo, and in avoiding the dry manner of the German school, adopted a style the most extravagant and bombastic that can be conceived; in aiming at grace and variety of attitude, he fell into affectation, grimace, and distortion. He was followed in the peculiarities of his style by Christopher Schwartz, Henry Goltzius, Joseph Heinz, and others.

Otho Venuis, or Van Veen, born at Leyden in 1556; being well versed in polite literature, and having applied diligently at Rome to the study of the antique, and the works of the great masters, acquired a correct design, a delicate style of handling, and a profound knowledge of the chiar' oscuro; his imagination was lively; he gave considerable grace to the airs of his heads; his draperies are well cast, and give much dignity to his figures; he was the founder of the broad manner of chiar' oscuro, and brilliant style of colouring, which were brought to perfection by his disciple, Rubens, by Vandyck, and the other masters of the Flemish school, and which shed their influence with irresistible power and fascination on the works of all succeeding masters. About this time the attention of the Flemish masters, which had hitherto been directed principally to historical composition, began to be applied to the painting of conversations and landscape, scenes of common life, animals, fruit, flowers, and other objects of still life; and as our limits necessarily preclude us from entering much further into detail on the subject, we briefly notice them according to this classification.

Rubens, born 1640, in historical works, as well as in his landscapes, exhibits the most brilliant and scientific manner of colouring of any master who has yet been known; his chiar' oscuro is managed with the greatest effect, his imagination is fertile and well supplied from the extent of his classical attainments; but it is much to be regretted, that the principles of colouring, and chiar' oscuro, of which he acquired so profound a knowledge from the study of the works of Titian and Paul Veronese, during his stay at Venice, were not associated, (as in the works of the Caracci,) to a more pure and graceful manner of design, more dignity of character in his male figures, and more elegance and delicacy in his females. The beauties and defects of his manner were adopted by his disciples, Vandyck, Jordaens, Diepenbeck, &c.; and we have no hesitation in asserting, that it was to the genius of Rubens, who threw so much light on the principles of colouring and chiar' oscuro, that the great excellence of this school is to be ascribed in all the departments of art to which they attached themselves.

Of the painters who have rendered themselves famous by their excellence in conversations, drolls, merry-makings, and similar subjects, the principal are Teniers, Ostade, G. Douw, Jan Steen, Terburgh, Metzu, Netscher, Mieris, and many others of merit. In the department of landscape, which was cultivated with much success, are Paul Brill, the Breughels, and Roland Savery. The art was afterwards carried to the greatest perfection by the Dutch masters, P. Potter, Cuyp, C. du Jardin, P. de Laër, Wynants, and Ruysdael.

The landscapes of P. Brill, the Breughels, and Savery, are distinguished by a richness of invention, a laborious minuteness of detail, and an exquisite neatness of finish; the figures are introduced with much taste, drawn with accuracy, and finished with delicacy and spirit. Their composition is, however, often crowded and redundant, and destitute of that character of grandeur, arising from simplicity of parts, which is so admirable in the landscapes of A. Caracci; Dominichino, Claude Lorraine, and the other masters of the Italian school.

The landscapes of P. Potter, Cuyp, and their contemporaries, some of whose names we have just mentioned, exhibit more just views on the subject: They consist, indeed, of the most ordinary and familiar objects, (a characteristic of this school,) deriving their chief interest from the exquisite manner in which they are treated. In seizing those accidents of nature, those transitory and varied effects of light and shadow, in the truth of representation of the individual parts, in beauty of colouring, and consummate dexterity in the mechanism of the art, they stand altogether unrivaled; while their excellence in the introduction of figures and animals, drawn with much truth and character, still further enhances the value of their works.

But of all the masters of this school who have so eminently advanced the art, the first place must be assigned to Rembrandt. We shall quote his character as given by professor Fuseli; in it he has appreciated, with just discrimination, the merits and defects of this extraordinary person: "He was undoubtedly a genius of the first class, in whatever is not immediately related to form or taste. In spite of the most portentous deformity, and without considering the spell of his chiar' oscuro, such were his powers of nature, such the grandeur, pathos, or simplicity of his composition, from the most elevated or extensive arrangement to the meanest or most homely, that the most untutored and the best cultivated eye, plain common sense, and the most refined sensibility, dwell on them equally enthralled; Shakespeare alone excepted, no one combined, with so much transcendent excellence, so many in all other men unpardonable faults, and reconciled us to them. He possessed the full empire of light and shade, and of all the tints that float between them. He tinged his pencil with equal success, in the cool of dawn, in the noontide ray, in the vivid flash, in the evanescent twilight, and rendered darkness visible. Though made to bend a stedfast eye on the bolder phenomena of nature, yet he knew how to follow her into her calmest abodes; he gave interest to insipidity and baldness, and plucked a flower in every desert. Few like Rembrandt knew how to improve an accident into a beauty, or to give importance to a trifle." His figures, however, are without grace or dignity; his drawing of the naked is absolutely bad, and his heads are of a low and vulgar character, though full of that sort of expression in which he delighted. Of his merits as an etcher we shall have occasion to speak in another part of this treatise.

The Dutch school produced also many painters of still life, such as fruit, flowers, dead game, &c. In the latter, Snyders, a disciple of Rubens, excelled so much, that he was often employed by him in his historical subjects, where his labours could be useful. Amongst the flower painters are Van Huysum, and Rachel Ruysch, who have carried this department of the art to the highest conceivable perfection.

British.—With regard to the arts in Britain, till the reign of his present Majesty little progress was made; and although as far back as the reign of Henry the Fourth, considerable encouragement was given to portrait painting, it seems to have been practised principally by foreigners, who were occasionally invited by the sovereign or the nobility, while sculptors and architects were brought from Italy, to build or decorate sepulchral monuments and similar works. Holbein was amongst the first painters of eminence who practised the art in England; he was recommended by Erasmus to the protection of Sir Thomas More, and by him introduced to Henry the Eighth; from this time he resided the greater part of his life in England, and painted the portraits of the king and most of the nobility; he was also employed as architect and designer of jewellery ornaments for the king. From this time a long succession of artists, Italians and Germans, visited the country, as owing to the reformation, and the troubles occasioned by the civil wars, little encouragement and leisure were afforded for the cultivation of native talent. The most prominent in this catalogue are Zucchero, Vandyke, Sir P. Lely, Sir G. Kneller. During the reign of Queen Anne, King George, First and Second, from the political state of the country, the art was at a very low ebb. In the two latter reigns, however, we find the art principally practised by natives, but in such a wretched style that we consider the mention of their names quite sufficient; the chief of them are Jervas, Richardson, Aikman, Thornhill, Barret, Wooton, Highmore, Hudson, Hayman, and Worlidge. From this list must be excepted the respectable names of Cotes and Hogarth, the former a portrait painter of great merit,—the latter an artist who stands alone in the department of art which he practised. As his character has been ably drawn by Walpole, who justly considers him rather as a writer of comedy with a pencil than a painter, we shall quote as much of it as may give the reader some idea of the style of this extraordinary man: "If catching the manners and follies of an age living as they rise; if general satire on vices, and ridicules familiarized by strokes of nature, and heightened by wit, and the whole animated by proper and just expressions of the passions, be comedy, Hogarth composed comedies as much as Moliere. He is more true to character than Congreve; each person is distinct from the rest, acts in his sphere, and cannot be confounded with any other of the dramatis personæ; and if wit is struck out from the characters in which it is not expected, it is from their acting conformably to their situation, and from the mode of their passions, not from their having the wit of fine gentlemen. Moliere, inimitable as he has proved, brought a rude theatre to perfection. Hogarth had no model to follow and improve upon. He created his art, and used colours instead of language. His place is between the Italians, whom we may consider as epic poets and tragedians, and the Flemish painters, who are as writers of farce and editors of burlesque nature. Hogarth resembles Butler, but his subjects are more universal, and amidst all his pleasantry he observes the true end of comedy, reformation; there is always a moral in his pictures. Sometimes he rose to tragedy, not in the catastrophe of kings and heroes, but in marking how vice conducts insensibly and incidentally to misery and shame. It is seldom that his figures do not express the character he intended to give them. When they wanted an illustration that colours could not give, collateral circumstances, full of wit, supply notes."

Sculpture received great improvement from Rysbrack and Roubiliac, who introduced a better taste in sepulchral monuments, and discarded the stiff dry manner that till their time had been fashionable.

By the labours of several men of taste, who published many of the most distinguished remains of Grecian and Roman magnificence, and by the example and munificence of the Earls of Pembroke and Burlington, architecture began to appear, about the middle of the 18th century, in a state of more purity, and to throw off what remained of gothic barbarity.

Landscape painting, which had been hitherto cultivated in England with indifferent success, arose to great excellence in the works of Richard Wilson and Thomas Gainsborough. Wilson had more of a great genius and an elegant taste, and the subjects he commonly represented were conceived in a high style of composition; in these he frequently introduced figures from the heathen mythology, which were often better in the invention than the execution. He observed nature in all her appearances, and had a characteristic touch for all her forms. But though in effects of dewy freshness and silent evening lights, few equalled, and fewer excelled him, his grandeur is oftener allied to terror, bustle, and convulsion, than to calmness and tranquillity.—" Wilson," says Mr Fuseli, " is now numbered with the classics of the art, though little more than a fifth part of a century has elapsed since death released him from the apathy of cognoscenti, the envy of rivals, and the neglect of a tasteless public; for Wilson, whose works will soon command prices as proud as those of Claude, Poussin, or Elsheimer, resembled the last most in his fate, lived and died nearer to indigence than ease; and, as an asylum from the severest wants incident to age and decay of powers, was reduced to solicit the librarian's place in the academy of which he was one of the brightest ornaments." He died in the year 1782.

Gainsborough, without the benefit of assistance or instruction, and at a remote corner in Suffolk, by his own industry, genius, and application to the study of nature, acquired such excellence in landscape-painting, as few, with every opportunity of improvement, have attained. At a very early period of life he settled in London as a portrait-painter, which branch of the art he all his life practised for subsistence, but the study of landscape only was his favourite pursuit. His style was the representation of English scenery, which he embellished with appropriate figures, cattle, and other interesting circumstances of rural life, treated in a manner full of truth and simplicity. His portraits are admirable for their striking resemblance; and although they display a masterly execution, and an intelligence of colour and effect, yet he produced them with little effort, as he applied to this branch of the art only from necessity, and never rested his claims for reputation on his works of this description. He died in 1788, aged 60.

The genius of Sir Joshua Reynolds effected a wonderful revolution in the arts in England. He was originally a pupil of Hudson, but on his return from Italy, where he studied for three years, he adopted a style entirely new; his admiration of the Venetian and Flemish masters seems to have led him exclusively to the study of their works, and had the greatest influence on his practice through the rest of his life. He is remarkable for the amazing brilliancy and splendour of his colouring,—for breadth of chiar' oscuro,—for the ease and elegance and variety of his attitudes,—for his wonderful sagacity and talent of seizing the characters of the persons he represented, and for the air of gentility he has been so successful in giving them. Although the English school is indebted to him for the broad manner of its chiar' oscuro, and for its brilliancy of colouring, we cannot but think that his example has been highly injurious to the arts in this country, as sanctioning a loose and careless style of design, a neglect of the details of nature, and having been the means of introducing a taste for gaudiness and glare, which have been too often mistaken for brilliancy and harmony, and have usurped, in too many instances, the place of fine design, character, and expression.

Sir Joshua occasionally painted history; but as his taste led him only to colouring and effect, and as he had a very slender foundation of drawing, his works are not remarkable for those beauties which relate to form, and possess none of the detail of nature which is so conspicuous in Titian.

In his search after colouring, and what is called the *Venetian secret*, he made use of many substances, which, being ill calculated for pigments, have faded entirely, and left a great proportion of his works, on which they had been employed, in a condition little better than monochroms.

James Barry, a native of Cork, was the first artist of the English school whose enthusiasm for the art led him, in spite of the tasteless apathy of the public, to neglect the lucrative profession of portrait-painting to engage in the arduous pursuit of history. By the friendship of the Burkes he was enabled to visit Italy, where, during a residence of several years, he acquired a profound knowledge of the principles of the art. Barry's whole soul was given up to painting; and, on his return to England, finding no encouragement for historical painting, and conscious of his own powers, in order to refute the opinion of Winkelmann and other foreigners, who had asserted, that, from the humidity of our climate, it was incapable of producing genius or talent in the arts, he made the magnanimous and disinterested proposal to the Society of Arts, to paint, for their hall in the Adelphi, a series of pictures emblematic of the progress of society from rudeness to refinement. This offer being *thankfully* received by the society, he engaged in the work with his wonted ardour and enthusiasm, and finished six pictures in three years,—a space of time wonderfully short, considering the size of the pictures, the amazing number of the figures, and that the whole was executed by his own hand; and we hesitate not to assert, that the success was as complete as his motives were noble and generous; and although many parts of this great work are not altogether unobjectionable, particularly the fourth picture, or the Triumph of the Thames, where Captain Cook, and several of our circumnavigators, in their proper costumes, are represented in the character of marine deities, tritons, and the like, we cannot withhold our warmest applause from the manner in which the whole has been conceived and executed. If any thing were wanting to excite our highest admiration, we have only to add, that such was his anxiety for the completion of his work, that, in order to attain that great end, he sacrificed every personal comfort and enjoyment, subsisting on the produce of designs and etchings, executed after the *labours of the day* were concluded.—"To these pictures I have," says Barry, "endeavoured to give such a connexion as might serve to illustrate one great maxim of moral truth, viz. that the obtaining of happiness, as well individual as public, depends upon cultivating the human faculties. We begin with man in a savage state, full of inconvenience, imperfection, and misery: and we follow him through several gradations of culture and happiness, which, after our probationary state here, are finally attended with beatitude or misery." The *first* picture is the story of Orpheus, or the first dawnings of civilization, in which Orpheus appears as the founder of Grecian theology, uniting in the same character the legislator, the divine, the philosopher, the poet, as well as the musician. The *second* picture is a Grecian Harvest-home, or Thanksgiving to the rural deities Ceres, Bacchus, &c.; the *third*, Crowning the Victors at Olympia; the *fourth*, Commerce, or the Triumph of the Thames; the *fifth*, the Distribution of the Premiums in the Society of Arts; and the *sixth*, Elysium, or the State of Final Retribution. The first, second, fourth, and fifth, are 15 feet 2 inches in length, by 11 feet 6 inches in height. The other two are 42 feet in length, and of the same height as the others.

The most prominent feature in Barry's character was his enthusiasm for the art, and for every thing intimately or remotely connected with it. He entertained the highest notion of the dignity of his profession, the great object of which he conceived to be moral instruction as well as pleasure; and to this end all his works have a tendency. Many of his figures exhibit truth, beauty, character, and expression in a manner not surpassed by the greatest masters; while in the representation of the elegance and grace of the female form, he has given specimens of his talents not inferior to Corregio or Parmeggiano. His colouring, although, when in Italy, he studied much the works of Titian, is not equal to his other excellencies. He was of an irritable disposition, which frequently hurried him into excesses, and embroiled him with his fellow-members of the Royal Academy, from which he was finally expelled. Of the merits of this dispute, we have no means of forming an accurate judgment; but from what appears in the correspondence on the subject in his works, (of the accuracy of which we entertain no doubt,) his intentions were of the most liberal, public-spirited, and disinterested kind; and if his conduct was intemperate, the charge may, with justice, be retorted on his adversaries. It may be thought that we have occupied too much space on the character of this extraordinary man; but we feel ourselves justified, both from our admiration for his genius, and because his character has been vilified in a literary journal of high reputation,* in a manner that we conceive most unjust and unwarrantable. He died in the year 1806, aged 65.

John Opie painted history and portrait; his works are distinguished by a simplicity of composition, boldness of effect, uncommon strength of character, (though without dignity or grace,) and a faithful expression of individual nature. Few painters have shewn so perfect an eye for the purity of colour; his management of the chiar' oscuro is masterly, broad, and intelligent. As, from the circumstances of his situation in early life, he had no opportunity of acquiring a correct design, his figures are commonly exact transcripts of his model, rendered with fidelity, without any thing of the ideal. He died in the year 1807, aged 46.

England has also to boast of many other historical painters; the chief of whom are, the present venerable president Mr West, Mr Northcote, Mr Fuseli, Mr Stodart, Mr Bird, the late Mr Tresham, &c. In the department of portrait, the late Mr Hoppner, Sir T. Lawrence, Sir W. Beechy, Mr Shee, Mr Owen, Mr Howard, &c. In conversations, and other familiar subjects, our own countryman, Mr Wilkie, has exhibited the perfection of the Dutch school, separated from its grossness, and adorned with the elegance and pathos of Greece. Landscape, however, is the branch of the art which has been cultivated most generally, and with the greatest success, both in oil and water-colours. Its professors are so numerous, that we feel it would appear invidious, where so many are excellent, to particularize a few; we may, however, mention Mr Turner, who, in every department of landscape, has not been surpassed by the best masters. In sculpture, Mr Flaxman, Mr Brown, Mr Banks, Mr Westmacott, and many others of eminence, have done much for the credit of English art; and in the success of their exertions they have kept pace with the improvement of the other branches of the fine arts.

Before dismissing this part of our subject, we hope our nationality will be indulged in dedicating a few lines to a view of the art in our own remote corner of the island; and although little encouragement has been afforded by those whose duty it is more immediately to patronize genius, we think that Scot-

* See Edinburgh Review *on the works of James Barry.*

land has already shewn, that patronage and encouragement only are wanting to raise her name in art, as it is already distinguished in science and arms.

The first Scottish painter on record was George Jameson, called the Scottish Vandyke, a native of Aberdeen, born in the year 1586; he studied at Antwerp under the celebrated Rubens, and was contemporary with Vandyke. The works of Jameson are little known out of Scotland, although they are to be found in most of the mansions of the Scottish nobility. He painted portraits both in oil and in miniature, and, occasionally, both history and landscape. His style is soft and delicate, with a clear and brilliant colouring, without much shadow. His pictures have been often mistaken for works of Vandyke. His portrait, painted by himself, is in the gallery of painters at Florence. He died 1644.

Sir John Medina, son of a captain in the Spanish service, but born at Brussels, settled in Scotland, where he died in 1711. He was knighted by the duke of Queensberry, the lord-high commissioner. His works, chiefly portraits, are of great merit; and, as he took Rubens for his model, are well coloured. His portrait is also in the gallery at Florence. He was much employed by the Scottish nobility.

William Aikman, born in Aberdeenshire 1682, having studied in Italy for three years, was, on his return, much employed in Scotland in portrait-painting. He died in 1731, aged 49.

Alexander Runciman, born 1736, painted history and landscape. He had served an apprenticeship to a house and coach-painter in Edinburgh, during which time he acquired considerable knowledge in the mechanique of the art. By the patronage of Sir John Clerk, a Scottish baronet, he, as well as his brother John, were enabled to visit Italy, where the latter, a young man of considerable promise, but of a delicate and consumptive habit, fell a victim to his unremitting attention to study.

Alexander, before his return "gave a specimen of his abilities, in a picture of considerable size, representing Ulysses surprising Nausicea at play with her maids; it exhibits, with the defects and manner of Giuglio Romano, in style, design, and expression, a tone, a juice, and breadth of colour resembling Tintoretto." On his return to his native country, he was employed by his patron to decorate the hall of Pennycuik with a series of pictures taken from the poems of Ossian, in which he has shewn great vigour of fancy and an agreeable tone of colouring; some of these subjects he etched. He occasionally painted other historical subjects, and landscapes, in imitation of the style of G. Poussin or Dominichino, in the most of which, that we have seen, we do not conceive him to have been very successful, either in composition, colouring, or effect. In this judgment, we are aware that few of the *dilletanti* of this country will join us; but, with the highest admiration for his genius and talents, we are of opinion that even his best works will admit of no competition with the great masters of the Italian schools, and that, in estimating his character, great allowance must be made for the disadvantages of one, who, for a subsistence, was obliged to exercise the *trade* of house-painter, and, on his being appointed master of the Trustees' academy, to submit to the drudgery of teaching boys the first rudiments of drawing. He was also employed in painting scenery for the Edinburgh theatre, in which he displayed his wonted taste and great versatility of talent. He died 1785, aged 49.

John Brown was an eminent designer of portraits, which he executed generally in black-lead, in a miniature size; they were esteemed correct likenesses, and beautifully finished. He never attached himself to painting, and the works we have described are all that is known. He was a man of elegant taste, and wrote, when at Rome, a treatise on the *Poetry and Music of the Italian Opera*. He died at Edinburgh in the year 1787.

Allan Ramsay, son of the celebrated author of the "Gentle Shepherd," was born about 1709. Having studied in Italy, on his return he settled in Edinburgh, where he painted portraits, and was much employed; he afterwards removed to London, and was appointed portrait-painter to his present Majesty, whose portrait he often painted. His drawing is good, but his colouring is dry and poor, and the chiar' oscuro without force.

Jacob More, born at Edinburgh about the year 1743, was the son of a respectable merchant. He had been at first apprentice to a mechanical trade; but having completed the period of his indenture, his ardent love for the art in which he afterwards so eminently excelled, led him to engage himself as an apprentice with Mr Norrie of Edinburgh, professionally a house-painter, but who also devoted himself with some success to the painting of landscape. Having finished a seven years appreticeship with Mr Norrie, by the liberal patronage of Mr Alexander, a banker in Edinburgh, and of Chief-baron Montgomery, he was enabled to visit Rome in the year 1770, where he continued till his death, which happened in the year 1796, in the 53d year of his age.

The style of Jacob More is distinguished by a considerable degree of classical feeling, and his earlier works have much of the taste, character, and even handling of R. Wilson. From the few specimens which we have seen of his landscapes, painted after his removing to Italy, it may be considered presumptuous in us to express an opinion of his last style; but it appears, from what we have seen, that there is a peculiarity of taste in his latter works, both in point of composition and colouring, which injures them when compared with some of his earlier productions. More was highly respected at Rome, and honoured with the patronage of the late Pope Pius VI. for whom he executed several pictures.

David Martin, a pupil of Ramsay, born about the year 1730, for many years was most extensively employed as a portrait-painter; his drawing is sufficiently correct; his colouring and chiar' oscuro are destitute of force, and his touch and style of handling without freedom or boldness; his portraits, however, were esteemed excellent likenesses, and till his death he continued to enjoy the most extensive patronage in Scotland.

As an engraver he is entitled to much credit; his principal work is a large plate of the late Chief-justice Lord Mansfield in his robes, in which he has shewn considerable power and dexterity in handling the graver; he also engraved several landscapes, and scraped a few portraits in mezzotinto, amongst which are those of Hume the historian, and of J. J. Rousseau, both after Ramsay. He died at Edinburgh about the year 1796.

Mr David Allan, born in 1744, studied at Rome, and was, on the death of Mr Runciman, appointed his successor in the academy, which place he occupied till his death in 1796. His works consist principally of Scottish marriages, merry-makings, designs for Scottish songs, many of which, as well as subjects of Italian costume, he etched or executed in aquatinta; he also executed plates, in the latter manner, for an edition of the Gentle Shepherd, which was printed by the Foulis of Glasgow. The only work in a classical style by him, is the Origin of Painting, of which there is an engraving by Cunego of Rome.

About this time flourished John Bogle, an artist who devoted himself to miniature-painting. He died about the year 1804.

Mr Allan was succeeded in the academy by Mr John Graham, a native of Scotland, but who had resided for many years in London as a historical painter.

On Mr Graham's accession to the academy, instead of the humble office of improving the mechanic arts, for which it was originally destined, it became also a school of design for the education of artists. A magnificent collection of plaster-casts, from the choicest reliques of antique sculptures, was formed at the expense of the Board, to which have recently (1816) been added a selection from the finest specimens of the Elgin marbles, while the noble principle of emulation is excited by annual distributions of premiums for the best works in historical compositions, and drawings and models from the antique. With such advantages, joined to the unremitting exertions of Mr Graham, who secured the esteem and veneration of all who have been pupils of the academy, more advancement has been made within the last 20 years in the arts of this country, than during a whole century preceding. Mr Graham is well known by many celebrated historical pictures which he has painted, viz. David instructing Solomon, in the gallery of the Earl of Wemyss at Gosford; the Burial of General Fraser, engraved by Nutter; a scene from Othello, for the Shakespeare gallery, and engraved in that collection, &c. Mr Graham died in 1817, and has been succeeded in the academy by Mr A. Wilson.

Amongst the most distinguished persons who have been educated under Mr Graham, are Mr Wilkie and Mr John Burnet; the former we have already mentioned; the latter a most excellent engraver, who has executed many plates after Wilkie, (the principal of which is the Blind Fiddler,) and several others from the Dutch and Flemish masters, which rival in elegance and spirit the works of Le Bas. Another disciple of this school was Mr James Burnet, a brother of the preceding, whose genius raised itself above the mechanical trade to which he was bred. On finishing his apprenticeship he went to London, where his merit was fully acknowledged by public encouragement; and in landscapes, with cattle and other animals, in the style of Paul Potter, (we are certain our national partiality does not mislead us,) he has never been by many degrees equalled by any painter in the British empire. As he died in 1816, at the early age of 27, his works are not numerous: His landscape is conceived with great truth, his colouring, and effect of light and shade, is harmonious and brilliant, and his animals are drawn with firmness, accuracy, and minuteness of detail, and justness of expression, worthy of Paul Potter or K. du Jardin.

The advancement of Scottish art has been also greatly promoted by Mr Alexander Nasmyth, a gentleman to whose unremitting personal exertions in the department of landscape, as well as by the great number of eminent artists who have received the rudiments of their education under his care, the arts in Scotland are deeply indebted; and in this enumeration must be included, besides his eldest son, Mr P. Nasmyth, and even the female branches of his own family, almost every Scottish artist who has appeared for the last 30 years.

Mr Nasmyth was originally a pupil of Allan Ramsay, and subsequently studied at Rome as a portrait-painter, but he is known chiefly as a painter of landscape; and the excellence of his works in this way have been amply acknowledged on both sides of the Tweed. In the department of portrait our country has to boast of Mr Henry Raeburn, who is surpassed by few artists of the English school; and his merits have been more fully acknowledged by his being recently elected a member of the Royal Academy of London.

We have been more full in this part of our subject than may meet the approbation of many of our readers; but as the biography of our Scottish artists has always been much neglected by writers on the history of the art, and as the notices published in the southern part of the island are generally both extremely defective and erroneous, we conceive it only doing justice to the cause of the art, to put on record what information our local situation puts it in our power to acquire.

PART II. PRINCIPLES OF PAINTING.

Chap. I. Introduction.

Painting, in whatever subject it may be employed, or in whatever material it may be executed, may be considered as comprehending; 1st, Invention, composition, and expression; 2d, Drawing, or design; 3d, Chiar' oscuro, or the distribution of light and shadow; and, 4th, Colouring.

The first is the intellectual part, which conceives the subject, determines the persons and things necessary to the developement of the main action of the piece, according to the various circumstances of age, character, expression, and costume, and which disposes and arranges them in the most appropriate and agreeable manner, and regulates the colouring and effect most suitable to the character of the subject.

Drawing, or design, embodies the conceptions of the painter, as far as relates to form, and assigns to each object its proper figure and magnitude, according to its perspective situation, and to its relation to the spectator with regard to height and distance.

Chiar' oscuro, is that distribution of light and shadow, which, though founded on, and regulated by the immutable laws of nature, places the objects in a picture under such an artificial arrangement as may best contribute to the effect of the work as a whole, as well as to the proper distinction or subordination of its several parts, according to their respective value or importance.

Colouring, besides giving to each object the utmost possible truth of resemblance, according to the appearances of nature, in the several states of full light, demi-tint, shadow, and reflection, also regulates the choice, intensity, and arrangement of the different colours in a picture, according to certain laws of harmony, and with a reference to the character of the work, whether gay, cheerful, grave, dignified, or sublime.

Sect. I. *Of Invention, Composition, and Expression.*

Invention does not necessarily imply that the subject should be a story invented or conceived by the painter in the first instance; on the contrary, the materials *may be*, and indeed commonly are, supplied by the poet or historian, and sufficient scope is still afforded for the display of his genius in the way the painter may conceive it, in the choice of his materials, in the dignity, variety, and contrast of his characters, in the point of time he may have taken, and in the arranging his back-grounds, and other minor subsidiary circumstances which are necessary to the complete elucidation of the subject.

As the painter cannot, like the poet and historian, prepare the mind of the spectator, and lead him on from the beginning of his narration to the final catastrophe, which may include a series of years,—and by the descriptions, episodes, and reflections on the past and present, and conjectures on the future, impress him with feelings suitable to the subject, and convey a full idea of the persons engaged in the action,—his means are in this respect very limited. He is restricted to one main action, to which every other must be subsidiary, and to one point of time. He cannot describe the workings of mind, nor the agency by which they are excited, but by the effect on the actions and gestures of the body, and the expression of the countenance. Thus, many subjects so striking in poetry or history are totally unfit for the painter. "Of this description is the incident in the Iliad, where one of Priam's younger sons falls before the superior force of Achilles, and solicits his life on account of his youth: "Wretch!" exclaims the furious hero, "dost thou complain of dying when thou knowest that Achilles must shortly die?" Such also is the celebrated passage in Corneille's Horatii, where the father of one set of the combatants, on being informed that his son, left single against his three antagonists, had turned his back, appears much agitated and enraged; and when one of his attendants asks, What should your son have done against such disparity? instantly retorts, "He should have died." Enthusiastic strokes of energy and sublimity, like these irresistibly command warm and universal admiration; but unfortunately for the pencil, they defy utterance by any power but words. Of the same class, also, is what passed in the council preceding the revolution, between James the Second and the old Earl of Bedford, whose son, the illustrious Russell, had suffered death in the foregoing reign. "My Lord," said the king, addressing himself to the earl, "you are an honest man, have great credit, and can do me signal service." "Sir," replied the earl, "I am a feeble old man, and very unable to afford you any considerable assistance; but I had a son," added he, "who, if he had been living, could have served your majesty in a more effectual manner." James was so struck with this reflection, that he forbore to answer another word. This, which is a very striking passage of history, with the other passages just mentioned, and many more of a similar nature, have frequently been pointed out by those unacquainted with the proper limits of art, as subjects well calculated for the pencil; but this is so far from being true, that they are all of them deficient in many requisites to make a good picture: They all allude to distant events, and complicated circumstances; enter into feelings which have no decided outward or visible signs, and exhibit only ambiguous expression of countenance, and unintelligible action.

In order to acquire just notions of excellence in this most important part of painting, the vigorous and eloquent conceptions of the Florentines, and the more chastened, and expressive, and graceful productions of the Roman school, must be profoundly studied and investigated. The study of the antique will improve and refine our ideas of grace and elegance, and their technical application will be brought home and illustrated by the contemplation of the works of Correggio and Parmeggiano.

The grand style, (to which our observations more particularly have a reference,) comprehends two great classes of composition, the allegorical and dramatic; the best exemplifications of the first are to be found in some of the works of Michael Angelo, and of the second in those of Raffaele.

The Venetian and Flemish schools form another class, which, seeking only colouring and effect, has been called the ornamental.

Of Michael Angelo's and the allegorical style, the Capella Sistina contains undoubtedly the most noble examples, consisting of a series of subjects taken from scripture, which fill the walls and ceiling of the chapel, together with insulated figures, patriarchs, prophets, and sybils, as well as groupes, which have a reference to the main design of the work, and fill up spaces the forms of which would not admit regular historical composition. In Mr Duppa's life of this artist, a plate is given of the whole work, exhibiting the general disposition of its component parts; to this we refer the reader, aware that the following quotation will not be well understood without it. "Its subject," says Mr Fuseli, "is theocracy, or the empire of religion, considered as the parent or queen of man,—the origin, the progress, and final dispensation of Providence, as taught by the sacred records. Amid this imagery of primeval simplicity, whose sole object is the relation of the race to its founder, to look for minute discrimination of character, is to invert the principle of the author's invention. Here only is God with man. The veil of eternity is rent; time, space, and matter teem in the creation of the elements and of earth; life issues from God, and adoration from man, in the creation of Adam and his mate; the transgression of the precept at the tree of knowledge proves the origin of evil, and of the expulsion from the immediate intercourse with God; the economy of justice and grace commences in the revolutions of the deluge and the covenant made with Noah, and the germs of social character are traced in the subsequent scene between him and his sons; the awful synod of prophets and sybils are the heralds of the Redeemer, and the host of patriarchs the pedigree of the Son of Man; the brazen serpent, and the fall of Haman; the giant subdued by the stripling in Goliah and David; and the conqueror destroyed by female weakness,—are types of his mysterious progress, till Jonah pronounces him immortal; and the magnificence of the last judgment, by shewing the Saviour in the judge of man, sums up the whole, and reunites the race to the founder."

This work exhibits the allegorical style in its utmost perfection of sublimity and grandeur.

Of the dramatic style of Raffaelle, an examination of one of the cartoons will give the most perfect idea. "In the cartoon of the sacrifice of Lystra," says Mr Opie, "the inhabitants of that city are about to offer divine honours to Paul and Barnabas; and it was necessary that the cause of this extraordinary enthusiasm, the restoring the limb of a cripple, should be explained; which, to any powers less than those under consideration, would have perhaps been insurmountable; for this reason, that painting having only the choice of one single moment of time, if we take the instant before the performance of the miracle, how can we shew that it ever took place? if we adopt the instant after, how shall it appear that the man had ever been a cripple? Raffaelle has chosen the latter, and, by throwing his now useless crutches on the ground, giving him the uncertain staggering attitude of a man accustomed to support, and still in some degree doubtful of his newly acquired power, and by the uncommon eagerness with which he makes him address his benefactors, points out both his gratitude and the occasion of it; and, still further, to do away any remnant of ambiguity, he introduces a man of respectable appearance, who, lifting up a corner of the patient's drapery, surveys with unfeigned astonishment the newly and perfectly formed limb.

St Paul preaching at Athens is another instance of the fine style of Raffaelle, both as to invention and expression: The apostle stands in an elevated situation, his attitude is simple and dignified, impressed with the character of greatness and sublimity which commands respect and attention, admirably contrasted with the expression of the different emotions of his audience, according to the manner in which they receive the truths he is supposed to inculcate, whether of doubt, or faith, unbelief, ridicule, or ambiguity.

"We see in his (Raffaelle's) works," says Mengs, "a variety of things without contradiction; violent passions without affectation and without baseness, manifesting the expression sometimes even in the motion of a finger, and the effect of the passions in the tendons of the muscles. He knew how to employ and make many things beautiful, which in many cases would have been otherwise defective, merely by the happy manner of introducing them; in short, between the works of Raffaelle and those of other painters, there is as much difference in expression as there would be between Alexander the Great and the comedian who represents him: the latter might *studiously* represent the actions of the original, but certainly not so naturally as he who acted from *impulse*. His great superiority must be ascribed to his having so well discerned the true effects which the emotions of the soul produce on the body; while others, not considering that every extreme is vicious, that every action carried to excess is remote from truth and nature, in place of dignity have represented phrenzy,—of moderation, insensibility."

The Venetian school forms what has been called the ornamental style, considering passion or expression as entirely subservient to picturesque effect, or brilliancy of colouring. Of this class also is the school of Rubens; and although his invention is copious, it cannot be adduced as a model, either in expression, or character, or dramatic pathos.

Sect. II. *Of Drawing.*

As the most important and recognisable qualities of objects are contained in their forms, and as without accuracy in their delineation other great qualities of art could convey no precise idea, and would be like an oration delivered in an unknown tongue, it follows, that drawing, or the representation of form, must be the foundation on which all the other excellencies of the art must be built.

The term *drawing* implies that part of the art which relates to the form of all objects; but in technical language it is often appropriated, by way of excellence, to the skilful delineation of the human figure; and in this restricted sense, in the course of our observations, we have most frequently applied it.

The different schools of painting, according to the principles by which they were directed, and by which they viewed nature, represented the human figure, and other objects in nature, in very different and opposite manners.

The Dutch and Flemish masters having in general no other object than the representation of local manners and customs, imitated nature as she appears to the eye, without selection, beauty, or dignity. This is the style of individual nature.

The Venetians, as well as many individuals of the other schools, aiming at a more elevated style of art, selected nature with more care, but in general satisfied themselves with their model without attempting to improve it. This may be called the style of select nature.

The ideal, or grand style, is founded on a selection of such perfections of nature as, from observation, may be found most appropriate to the aggregate of each character, and which never are found united in one model. "It is not easy," says Sir J. Reynolds, "to define in what this great style consists, nor to describe by words the proper means of acquiring it. But though there neither are, nor can be any precise rules for its exercise or acquisition, yet we may truly say, that it will always be obtained in proportion to our attention in observing the works of nature, to our skill in selecting, and our care in digesting, methodizing, and comparing our observations. The power of discovering what is deformed in nature, or, in other words, what is particular or uncommon, can be acquired only by experience; and the whole beauty and grandeur of the art consist in trying to get over all singular forms, local customs, and peculiarities of every kind. All the objects exhibited to our view have their blemishes and defects. The most beautiful forms have something about them like weakness, minuteness, or imperfection; but it is not every eye that perceives these blemishes. It must be an eye long used to the contemplation and comparison of these forms, and which, by long habit of observing what any set of objects of the same kind have in common, has acquired the power of discerning what each wants in particular. This long laborious comparison should be the first study of the painter who aims at the greatest style. By this means he acquires a just idea of beautiful forms; he corrects nature by herself, her imperfect state by her more perfect. His eye being accustomed to distinguish the accidental deficiencies, excrescences, and deformities of things, from their general figures he makes out an abstract idea of their forms, more perfect than any one original.

"This idea of the perfect state of nature, which the artist calls ideal beauty, is the great leading principle by which works of genius are conducted."

Although beauty is always agreeable, it derives its power and interest only from its being associated with grace, character, and sentiment, and from the mental sympathies which these excite, or the moral feelings of which, according to their mode or degree, they are the types. In a technical sense, however, every object may be said to be beautiful which, in form, character, attitude, &c. fitly expresses the object or passion intended.

Grace is the perception of beauty arising from those modes of gesture or attitude which are significant of delicacy of sentiment, amiableness of disposition, and refinement of manners, always, however, added to elegance and symmetry of form. The principles of grace must also, to a certain extent, direct the painter in every possible variety of character and attitude; it is obvious that it must be as various as the emotions or passions of the mind, or the actions or gestures of the body that represent them, and that, accordingly, no general rule can be given for its attainment.

In the representation of the finer and more delicate emotions, and in personages of peculiar elegance or refinement of character, to which the epithet of *graceful* more specifically belongs, it is in general to be expressed, as in the works of Corregio, by contours of gentle undulation, variety of outline, and by avoiding angular turnings of the members, and all abrupt transitions. In the stronger and more forcible expressions (which do not in the strict sense of the term belong to this class) as much of this principle will be admitted as is consistent with the nature of the subject, and without overstepping the modesty of nature, and thereby degenerating into bombast and extravagance, as in the works of Bartholomew Sprangher, Goltzius, and other masters of that branch of the German school. This principle is also applicable by analogy to every visible object, from man to the lower animals, and even trees and other inanimate things, the nature of which permits the exertion of the faculty of taste in the choice of form or attitude.

Although these motions or positions of the body which we call graceful, are generally so considered only from their effect on the external sense, Mr Alison has sufficiently shewn, that they derive their power of exciting agreeable emotions from their being associated in our minds with ideas of ease, comfort, serenity of mind, or some other internal cause. If a man stand in an upright position, both his legs being straight and parallel, his head looking right forward, and his whole body square to the front, like a soldier in the ranks, his attitude will be stiff, disagreeable, and *unpicturesque*. On the contrary, if he rest the weight of his body on one leg, and place the other in any way most conducive to his own ease, and give his head a slight inclination to one side, this attitude will be more or less graceful, according to the conformation of the person. Our sentiments, however, in these different attitudes, are ultimately deducible from another source than the pleasure they give the sense of vision, namely, that in the one they are associated with ideas of pain, exertion, and constraint, in the other of ease, comfort, and relaxation.

The antique statues afford the finest examples of the judicious adaptation of character to the subject: the Venus de Medici—of the exquisite beauty and grace of the female form, heightened by the most lovely expression of countenance; the Belvidere Apollo—of the mild dignity and elegance of the god of poetry, painting, and music; the Torso, or the Hercules—of power united to swiftness and agility; the Laocoon,—of dignified suffering elevated by the ideal; the Gladiator Borghese,—of vigorous manhood in powerful action; and the head of Milo—the coarse and brutal character of the unfortunate wrestler of Crotona.

Having acquired a scientific knowledge of the peculiarities as well as generic qualities of nature, by the investigation which, on the authority of Sir J. Reynolds, we have recommended,—the study of those monuments of ancient genius, and the works of the great masters of the Italian schools, will point out their application to practice.

The study of anatomy is indispensable to the true delineation of the human figure, as all muscular effort is momentary, and when the exertion is once made the muscles relapse into a state of repose, or at least exhibit an appearance quite different from what they had during the action which we have supposed to have taken place; the changes which are produced on the surface of the body during the action, can only be represented by the knowledge of the situation, use, and classification of those moving powers, as they may appear during the action, according to the state of the body with regard to plumpness or leanness, strength or delicacy, or the degree of exertion or effort by which it is effected. In the representation of animals, the assistance of comparative anatomy will also be required, in order to exhibit their several characters and actions with the greatest truth and propriety.

The thorough knowledge of the laws of linear perspective will also be found of primary necessity, in regulating the magnitudes of all objects that may occur in a picture, the declination or convergence of their several surfaces or boundaries, the forms of their shadows, and many other considerations, which if not attended to in this scientific way, often render the work unintelligible, and brand the painter with the stigma of ignorance of one of the most important and one of the most easily acquired parts of the grammar of his art.

The principles of architecture will also form an important part of the study of the painter, whether in decorating and illustrating his historical works, or in giving dignity and elevation of character to his landscape,

The branches of knowledge which we have just recommended will be found most useful auxiliaries in the exercise of his art, independently of this consideration, that no part of science is foreign to the pursuits of the painter—that there is nothing that enlarges the sphere of his knowledge, refines his general taste, or elevates his mind, which has not influence remotely or immediately on the character of his works.

The management of drapery, whether in casting the folds, or in disposing its shadows and colours, is of the greatest importance, in marking costume and character—in forming a ground for sustaining the various masses of light, shade, and colour,—and in uniting or binding together the groupes or figures of which the work may be composed. The arrangement of the folds ought always to be regulated by the motions or attitude of the figure, and with a reference to the quality of the stuff of which the drapery may be composed, and in such a manner as to clothe and not to conceal the character and proportions of the figure—without, however, going to the extreme, introduced by pedantry and ostentation of anatomical science, of exhibiting the muscles and more minute marking of the body under the drapery, as if it were wet and closely attached to the figure.

The character of the folds of the drapery must depend on the persons to whom it belongs. In grave or dignified personages, apostles, prophets, philosophers, and the like, the folds should be few and large; in nymphs, young females, and similar characters, the folds, as representing light and thin stuffs suitable to such personages, should be small and more numerous; while the intermediate characters, of which these may be considered as the extremes, will vary in mode or degree according to their rank, dignity, or expression, subject to the general principles which we have just laid down.

The draperies of Raffaelle afford decidedly the best examples for improving the taste of the painter in truth, simplicity, and grandeur; in this respect his school in general exhibits very good examples.

The Venetian school, conformably to the leading principles of their style, made their draperies rich and brilliant in point of colour and light, but without choice in the folds or regard to propriety in the introduction of rich stuffs, brocades, velvets, satins, &c. in subjects where simplicity and severity of character should have predominated.

How far this richness of stuffs in drapery is admissible in the grand style, is matter of doubt; though we cannot entirely reject it, we apprehend that it ought to be cautiously introduced, as detracting from the simplicity by which the grand style should be characterised.

The arrangement of the groupes, both in their relation to the work as a whole, and of the parts of a groupe to each other, forms another important part of the composition of a picture; and excellence in this can only be acquired by the study of the best works of art.

In disposing of the several parts or groupes of a picture, regard must be had to the following considerations. The parts must all contribute to the general effect, the principal figures must all be placed in the most conspicuous situations, while the accessory objects occupy the more subordinate places. The different groupes or masses in point of form should be such as to assimilate in the best manner with the proposed effect of light and shadow, and colour; while the different parts of the figures composing a groupe should, in their relation to one another, be combined in the most agreeable and distinct manner, so that the action of each may be obvious and free from doubt and ambiguity; nor should any figure be introduced which does not contribute to elucidate the subject of the piece.

Twelve figures havé been considered by the best masters as sufficient for one picture, and these may be divided into three groups, which is the greatest number that can be agreeably introduced.

In disposing the parts of a groupe, the principle of equilibrium should not be neglected; it consists in preserving a sort of balance between the two sides, and in such a manner as that the object on one side may have one to oppose it on the other, which ought, however, to be free from formality, and be even of a dissimilar character; thus, a tree or a cloud may be sometimes a sufficient balance to a human figure, a sitting one to a standing figure, and the like. That the form of the groupe should resemble a pyramid, has often been laid down as a rule; it has, when well managed, a fine effect, but it must depend on the subject, and can only be adopted with advantage when the number of the figures is small. Sometimes the groupes are arranged in a sort of serpentine or waved direction, as is finely exemplified in the fifth plate of S. Bourdon's *Works of Mercy*; but it is impossible to give exclusive preference to any particular mode of grouping; the study of the great masters supply examples of every mode; and taste and observation must direct in deciding on the manner in which the groupe is to be distributed.

From the very slight and general analysis which we have given of the antique in its adaptation of form, proportion, and action, to character and expression, it will be seen that this ought to constitute a very particular object of the painter's attention; that no excellence or correctness of drawing will atone for deficiency in the discrimination of character so necessary to the developement of the story. Thus the proportions which would be necessary to represent the mild and placid dignity of the Redeemer of mankind, would be ill suited (as we see in d'Arpino's picture of that subject) to the character of those who are scourging him and crowning him with thorns,—the power of Hercules must not be confounded with the majesty of Jupiter,---nor the captivating form of Venus be assigned to the goddess of Wisdom.

The distinctions of infancy, youth, manhood, and old age, both in the structure of the body and the form of the head, must, upon the same principle, exercise his discrimination, in all which states the human body exhibits well defined points of difference, which the study of anatomy and observation of nature will accurately point out to him.

We have at Plate 59. given a series of four heads, exhibiting the changes of the human subject from infancy to old age.

Fig. 1. is the head of a newly born infant; from the lower part of the nose to the *meatus auditorius* or aperture of the ear, a line is drawn forming a horizon; the chin and forehead are placed in a line perpendicular to it.

Fig. 2. is a child one year old; the forehead begins to project considerably, and the back part of the head is much enlarged.

As infants are born without teeth, the jaws are very narrow; in the space of a year they nearly double their breadth; the nose is short, being one-fifth of the whole height from the vertex to the bottom of the chin.

In the adult, Fig. 3. the growth of the nasal bone gives a pleasing form to the nose, and at the bottom of the nose if placed horizontally the nostrils are just visible; and the flatness which is characteristic of the infant head, disappears by the growth of the frontal sinuses.

Fig. 4. The most remarkable change in the heads of old persons is in the form of the face, in consequence of the loss of the teeth and gums, by which the external appearance of the face is greatly shortened; the size of the mouth is diminished, and becomes too small to contain the tongue, which often protrudes from the mouth in moving it.

The nose, also, having lost its support, bends forwards and hangs over the mouth, and, from the shortness of the lower part of the face, appears much larger than in youthful years. The nose and chin almost touch each other; and the chin, moving forwards and upwards, projects greatly from the original perpendicular line, as will be seen by comparing Figs. 3. and 4.

On comparing the character of the ideal heads of the antique, a very great deviation from the practice of nature may be observed. In the heads of the ancients the forehead is much more prominent than is ever to be seen in nature, and the nose forms a line in direct continuity with it, and without the usual indentation under the frontal bone which usually separates the nose and the forehead. In the natural head, on the contrary, the forehead and nose are not so prominent, while their respective profiles lie at different degrees of obliquity.

As this remarkable deviation from the truth of nature occurs only in their ideal personages, and not in those works which are avowedly portraits of individuals, it is clear that it must be the result of some principle or theory by which their practice was regulated. This we shall endeavour to point out. If we examine in profile the heads of the lower animals, of the dog, the horse, the ape, &c. we shall find, that, reckoning from the alveolary process of the jaws, a line along the forehead, and from the same point to the bottom of the chin, will subtend a very acute angle, while, performing the same process with the human head, the angle will be so obtuse as to deviate little from a right angle. This prominence of the forehead, (indicating the superior capacity of the cranium, and of course a greater quantity of brain, the seat of intellect,) and the consequent obtuseness of the facial angle, forming so marked a distinction between man and the lower animals, seems to have suggested to the ancients the idea of magnifying, in their representations of gods and heroes, the proportions of those parts, in which the superiority of the human character over that of the brute was so distinctly marked.

Professor Camper, in his Treatise on the Connexion between Anatomy and Painting, and Mr Charles Bell, in his Anatomy of Painting, have treated this subject at considerable length; and as our limits preclude us from considering it more in detail, we shall restrict ourselves to a very slight view of the subject, referring the reader to these works, assuring him that he will find in them much valuable information.

The method adopted by Camper was as follows: He assumed, as a horizon, a line drawn from the lower part of the nose across the head to the *meatus auditorius*, or aperture of the ear; the head, of course, is understood here to be viewed in profile. From the opening of the mouth a line is drawn along the nasal bone and forehead, and is called the facial line; and the angle subtended by this line from the horizon is called the facial angle. The first figure given by Camper, as an illustration of this principle, is the head of an ape; the facial angle subtended on the horizontal line *HL* from the point H at the opening of the mouth, by the line HI drawn up to the forehead, is 42 degrees, as exemplified at the bottom of Plate 59. Fig. 5.

Fig. 6. is the head of a Negro. The facial line subtends an angle of 70 degrees with the horizontal line.

Fig. 7. the facial angle is 80 degrees. This is the head of an European; the Negro and European exhibit the maximum and minimum of the facial angle of the human head; when the angle is increased beyond 80 degrees, it begins to approach the ideal style of the ancients; when the angle is diminished below 70 degrees, it approaches to the character of some of the monkey species.

Fig. 8. gives the facial angle of 100 degrees, and is that of the finest of the antique statues.

If we attend to the angle IHL, that is, the angle subtended by the facial line and the lower extremity of the chin, it will be seen that it becomes larger in proportion as the facial line ascends; and it is largest in the European.

With little exception, the size of the mouth is proportioned to the distance of the eye-teeth, or *dentes canini*, or, to speak more properly, the angle of the mouth commences at the first double-tooth or grinder; in apes, therefore, in the orang-outang, and the negro, the rim, or angle of the mouth, must be more distended than in the European, as the projection of the jaw enlarges the distance; and, on the same principle, the mouth of the antique must be the smallest.

Sect. III. *Of Chiar' Oscuro.*

Chiar' oscuro we have already defined to be that part of the art by which the light and shadow in a picture are distributed in such a manner as may best give the necessary roundness, prominence, distinctness, or obscurity to its several parts, or accommodate itself to the sentiment which the character of the subject should inspire, whether gay, melancholy, or terrific. Although the general distribution of the lights and shadows be left to the taste of the painter, it is obvious that they must be subject to the laws of linear perspective, which regulate the form and position of the shadows of every individual object, with a reference to the situation of the luminary which projects them; while their depth, strength, or delicacy will be determined by their distance, and modified by the state of the atmosphere through which they are supposed to be seen.

Invention and drawing address themselves to the understanding, but chiar' oscuro charms the sense; " it contributes to expression and sentiment, it lulls by breadth and gentle gradation, strikes by contrast, and rouses by abrupt transition. All that is grave, impressive, awful, mysterious, sublime, or dreadful in nature, is nearly connected with it. All poetical scenery, real or imaginary, " of forests and enchantments drear," where more is meant than expressed; all the effects of solemn twilight, and visionary obscurity, that flings half an image on the aching sight; all the terrors of storm, and the horrors of conflagration,—are indebted to it for representation on canvas. It is the medium of enchanting softness and repose in the works of some painters; and the vehicle by which others have risen to sublimity, in spite of the want of almost every other excellence. In allusion to these known and acknowledged effects, *the magic* of light and shade is become a proverb."

In the infinite variety of forms of composition, the rules which can be laid down for attaining excellence must be very general, leaving their application to the reader's sagacity, aided by the contemplation of the works of the best masters.

We have already observed, that the composition of the great masses or groupes, as well as the several parts of which each may consist, must always be disposed with a reference to the ultimate effect of their chiar' oscuro and colouring. Every picture should contain a principal light, which should illuminate the principal groupe or figure, and a mass of full deep shadow to improve the brilliancy of the light, and give repose to the eye; these will contrast with each other, and, by their power of opposition, give additional force to their respective effects. All unnecessary harshness or abruptness of transition of these extremes will be avoided by the intermediate half shadows and reflexes, which, by conducting the light into the depth of the shade by insensible gradation, will give delicacy and breadth, or, by more sudden and abrupt transitions, assimilate it to subjects of an opposite character: Every part should conduce to the unity of effect and the brilliancy of the principal light, which must not be repeated; but in order that it may not appear an insulated and unconnected spot, " revivifications" or echoes of it, subordinate in force or magnitude, should, by an artful concatenation, appear in passages where the objects are of secondary importance.

It has generally been laid down as a rule, with regard to the relative proportions of the light and shadow of a picture, that the middle-tint should occupy more space than the light, and the deep shadow more than the former; but this must always depend on the sentiment of the subject, to which the chiar' oscuro must at all times be subservient.

In distributing the light and shadow, the necessary depth may be produced, either by an object absolutely under shadow, or by one the local colour of which may assimilate with the mass of shadow, from its being, though illuminated, black, deep crimson, or blue, or of any other dark colour. In gay subjects, like those of Watteau, Metzu, and the Dutch masters, the opposition of colours, with less opposition of shadow, will be most proper; in those of a more grave or elevated character, such as those of Coreggio, Caracci, &c. the shadow should predominate.

In most cases, then, the tender degradation of the lights into the shades, which we have recommended, will be found most conducive to fine effect; for, in general, all abrupt transitions, when not required by the nature of the subject, are harsh and disagreeable. Of this defect, the works of Caravaggio frequently exhibit very striking instances.

By judicious management of the chiar' oscuro, objects which may be deficient in beauty of form, or ill adapted for their situation, (a circumstance of frequent occurrence, particularly in landscape,) the difficulty may be overcome, and the form rendered agreeable or inoffensive, by uniting the object to those that surround it, by throwing it either partially or wholly into the same state of light or shade, and thus rendering its figure more indistinct.

These principles are equally indispensible in every department of the art, from history and landscape down to the humble imitation of flowers and butterflies;—by them sublimity and grandeur will acquire new force, beauty and grace additional charms, and even baldness and insignificance will rise into importance when arrayed in the splendid attire of chiar' oscuro.

In order more fully to illustrate the principles of this part of the art, we have at Plate 56. given examples of the styles of the most distinguished *chiaroscurists*, taken, in the absence of original pictures, from the best engravings which we have been able to obtain; and as these examples are necessarily on a very diminutive scale, where the reader has an opportunity to consult the original engravings, the force of our observations will be more fully felt.

No. 1. is a specimen of the twilight effect of Coreggio; the subject is Christ on the mount of Olives.

The clear light is here confined to the two principal figures and the objects in their immediate neighbourhood; the two disciples, and the objects in the background, are enveloped in deep shadow, and the subdued light over the sky and distance forms an echo of the light on the principal figures, (which would otherwise be an unpleasant spot,) and disseminates it over the whole. Coreggio, as we have already stated, was the first who brought to perfection the principles of chiar' oscuro; and the example now before us is an admirable specimen of his dark twilight style of effect,—a striking characteristic of some of his finest works. The engraving is taken from the plate in the *Schola Italica;* the original picture was in the collection of the king of Spain at Madrid, and is at present, we believe, in the possession of the duke of Wellington.

No. 2. is a copy of what is called the *Hundred Guilder Print* of Rembrandt, taken from the print as restored by Captain Baillie. It is a very striking example of the powerful and broad manner of that master. The subject is Christ healing the sick and lame. The mass of light is brightest at the left side of the picture, extending from the bottom to the height of two-thirds of its breadth, and gradually diminishing in intensity till it loses itself in the deep shadow at the opposite side. The shadows of the several objects in full light are marked with delicacy, in order to preserve the breadth of effect, but still to give sufficient distinctness and precision to the parts; while those in the darker parts of the picture are marked with greater force and depth, and the lights at the same time are so judiciously united and subdued as to form an unbroken but finely varied mass. The brilliancy of the principal light on the left is greatly enhanced by the dark cap on the head of the whole-length figure on the fore-ground, which also forms a most agreeable contrast with the light on the rest of his body. Considering the small scale and great number of figures in this subject, great justice has been done to it by the engraver; but, in order more fully to comprehend our observations, we particularly recommend Captain Baillie's print to the examination of our readers.

No 3. is the *Fall of the Rebel Angels*, by Rubens, taken from the large engraving by Vosterman. The style of chiar' oscuro of this master, as exhibited in this example, differs greatly from that of Coreggio and Rembrandt. The light here is not confined to a particular spot, but is finely distributed over the greater part of the picture. The principal light is cast over the fallen angels towards the lower part; and is finely graduated into the sky on one side by bright, delicate, or more subdued tints, and ascends with greater power towards the top, and on the other side passes into deep shadow, forming a broad mass, and giving, by the strength of its contrast, infinite brilliancy and splendour to the tones of the carnations, and relief and distinctness to the various parts which compose the whole.

No. 4. is a small copy of the celebrated *Night Scene*, after Elsheimer, from the print by Count Goudt. The distribution of the light in this picture, according to the Count's engraving, we consider a specimen of very defective chiar' oscuro, as it consists of three principal lights, all equally brilliant, namely, that of the moon, a torch, and a fire; now, as the great end of chiar' oscuro is to give distinctness to the parts, and at the same time unity to the effect, and thus to concentrate the attention on the main action of the piece, it is obvious that the distraction arising from the competition of a plurality of rival lights must be completely subversive of this principle.

No. 5. is a subject by Rembrandt, from the engraving by Wood, analogous in point of composition and effect to the preceding; and as the defects in the picture of Elsheimer are here avoided, we have judged it a fit subject to be placed beside it. The chiar' oscuro of this work is a master-piece in this style of effect, remarkable for its breadth and harmony. The chief interest of the spectator is attracted to the fire and the figures immediately around it. The reflection of the fire in the water enlarges the mass of the principal light, which is carried off gradually upon the ground, trees, and figures, and diminishing in intensity as the objects that receive it recede from the fire. The moon is supposed to be behind a cloud, but the light which it throws over the sky forms a fine repetition of that of the fire; but, being kept much inferior to it in point of brilliancy, it does not distract the attention from it, nor injure the unity of effect of the whole. We are informed, that the original picture, besides the light of the moon and fire, contains also the last gleam of departing day; but it is sufficient for the purpose of illustration, to consider it as an example of the first two.

No. 6. is a very simple subject after Titian:—This, and that which follows, are taken from the collection of engravings called Teniers' Gallery. As the Venetian masters produced the effect of their chiar' oscuro more by intensity of colour than by the power of light and shadow, an engraving in one colour can give but a very imperfect idea of the excellence of their works; we therefore introduce this, rather as an example of fine management of the effect, as applied to portrait-painting, than as exhibiting the characteristics of the style of Titian. The principal light is on the figure, and it is finely carried through the picture by means of the sky and foreground, and the shadows over the rest, by their contrast, give great brilliancy to the lights.

No. 7. Annibale Caracci.—In the specimens which we have given in this plate, and indeed by far the greater number of the works of art, the quantity of shade predominates greatly over that of the light, and has in general the best effect; but when the subject is simple, and when the colours of the object admit, this order may be inverted, and the relative quantity of the shade may be diminished. The subject before us is an example of this. The light is here disseminated over the whole picture, with hardly any shadow except what is cast on the ground by the two figures. The carnations of the light figure acquire brilliancy and splendour by the contrast of the sombre hues of the dark figure under him; and the delicacy of the effect in the distance is greatly improved by the dark leg of the figure which comes against it. The greater part of the foreground is fully illuminated, and without any other shadow than what is projected by the figures and such touches of shade as are necessary to increase by their contrast the brilliancy of the light.

Sect. IV. *Of Colouring.*

Colouring, which in nature enchants, by the variety and harmonious gradation of its tints, is in art, when aided by its powerful auxiliary chiar' oscuro, the vehicle of sentiment and feeling; and by contributing so essentially to truth of representation, by marking and distinguishing the various qualities of bodies, speaks an energetic language intelligible to all.

Colour, like sound in poetry, should be an echo to the sense; and according to the general sentiment which the subject should inspire, it will be gay, lively, sombre, or solemn. "The terrors of the crucifixion must not be lost in the magnificent pomp of a triumphal procession, nor the pathetic solemnity of the *Last Supper* be disturbed by the impertinent gaiety of a Bacchanalian revel."

It will also aid the chiar' oscuro, by harmonizing, softening, and uniting the several masses;—it will distinguish by appropriate colour, the figures and other objects, each according to propriety of costume, and its importance in the composition;—by its harmonious arrangement the eye will be delighted by the brilliancy or vivacity of the colours in the principal light, or invited to repose in the depth and clearness of the shadow.

Although the Venetian and Flemish schools have, as we have already mentioned, excelled all others in this part of the art, propriety of sentiment was as little regarded by them in adapting the general tone of colour to the subject, as drawing or expression. Their great aim was brilliancy, beauty, and harmony of colour,—and in this they are unrivalled.

From the practice of the Roman and Florentine schools, it has been often disputed whether beauty of colouring was compatible with the grand style of composition; but although the high pitch of excellence to which they arrived in composition and expression, atones for their defects of colour and chiar' oscuro, we cannot grant that the absence of one of the most beautiful and interesting qualities of nature, which gives truth, illusion, and identity to bodies, and which operates so powerfully in contributing to sentiment and character, should be considered as a beauty. This also seems to have been the opinion of Michael Angelo himself, who wished, by the assistance of Sebastian del Piombo, to ingraft on his composition the colouring of the Venetians; and of Raffaelle, who, in order to perfect himself in this part, studied for a time under Fra. Bartolomeo.

In the grand style, the colouring as well as the form ought to partake of the ideal; and, on this account, we conceive that the colouring of Rubens, all brilliant, beautiful, and scientific as it is, is too individual in its style,—too little elevated in character for dignified composition. The colouring of Titian is better fitted for sublimity and grandeur.

The arrangement of colours, both in the lights and the shadow, forms a most important part in the effect of a picture; for the value of any colour or tint, in reference to its brilliancy or depth, will not be in the ratio of its actual strength or intensity, but will depend much for its force and beauty on the manner in which it is grouped or disposed, in respect to the parts immediately contrasted or harmonised with it; thus the carnations will derive peculiar clearness and delicacy, from being placed next blue or its kindred tints, purple, grey, &c.;—red, from being contrasted with green, and the contrary;—blue with yellow or orange;—black with white;—and their various mixtures or compounds will be subject to the same laws, in the manner which we shall presently point out.

This scientific contrast of colours, which was first discovered and practised by the Venetian masters, and forms the basis of all that is excellent or agreeable in this part of the art, is founded on certain principles of our nature, by which particular combinations of colour, in the same manner as of sound in music, produce on the senses by which they are respectively perceived the effect of pleasure or delight;—this is called harmony.

These combinations, which had been previously recognised as the foundation of excellence in colouring, long before any theory had been advanced on the subject, received full confirmation from the phenomena discovered by Buffon, and illustrated by succeeding philosophers, to which he gave the name of accidental colours, and which are observed when the eye becomes fatigued by the continued action upon the retina, of light of any particular colour. If we look steadily, for a considerable time, upon a spot of any given colour, placed on a white or black ground, for instance, a red wafer on a sheet of white paper, the spot of red will appear surrounded with a green border, and if we direct our eye to another part of the white ground we shall perceive a spot of the same size and form, but of a green colour; this is the accidental colour of the red; and by this process the accidental colour of every tint may be found. In conducting a picture, whether it consist of a few colours or of a great variety, the brilliancy of the whole, as well as of its several component parts, depends on their skilful arrangement, as pointed out by their accidental or contrasting colours. The following contains the seven prismatic colours, and we have placed opposite to each its contrasting one.

Prismatic Colours.	*Accidental Colours.*
Yellow,	Purple,
Orange,	Blue,
Red,	Green,
Violet,	Green, with a mixture of orange,
Indigo	Yellow, with orange,
Blue,	Orange,
Green,	Red.

In like manner white will contrast with black; brown, (which may be considered an impure red) with olive, an impure green; and so on of every variety of tint. But as a direct union of two such opposite elements as any prismatic or original colour with its contrasting or accidental one, will be harsh and unpleasant, a third will be required, to give delicacy and softness, and make a full concord; this is called a *harmonising colour*, and will consist of the original, diluted with the colour in the next weakest degree of brightness; thus yellow will form the harmonising colour to white, orange of yellow, red of orange, violet of red, blue of violet, and blue and green deeper shades of each respectively. The white, yellow, orange, red, and green (when pale,) may be freely admitted into the principal lights in all their degrees, as they may be required; the others, from their coldness and depth, can only be admitted into the shade; and if, from the nature of the subject, these cold and dark colours must be admitted into the lights of a picture, it should be done with caution, and in as slight a degree as possible, and the injury which may be done to the mass of light must be remedied by the contrast of a sufficient quantity of the brighter colours.

We have thus exhibited the various prismatic colours, with their respective harmonising and contrasting tints; and although, perhaps, without sufficient optical precision, considered in a philosophical point of view, at least with as much accuracy as for all technical purposes may be necessary. We shall now, for the sake of illustration, give a few examples of the practical application of these principles. In a composition of white objects, the pure colour, of course, will appear on the principal light only, black will be its contrasting colour; but as this may be, in its purest or deepest state, too strong for the nature of the subject, if it be diluted into a grey, the contrast will be perhaps sufficiently strong; the harmonising tint will be yellow, which, in proportion to its distance from the principal light, or as it passes into the shade, will gradually lose its brightness, and partake of the tint of its contrasting colour, till it unite with the grey or black; a reflected colour will be necessary to give roundness to the mass, and complete the harmony; this will be composed of some moderately warm tint, sufficiently reduced in brightness to accommodate it to its situation in the shade; as an insulated spot of any colour, (particularly if bright,) when not carried through the picture, is harsh and unharmonious, and destroys the repose of the whole, it will be necessary to introduce such objects as will, with propriety, sustain the colour of the principal light; but as these are only to be considered as secondary in the composition, and entirely subservient to the effect of this principal light, it must be so kept down in brightness or magnitude, as to maintain its situation as an auxiliary, without interfering as a rival with the principal; this is in strict analogy with what we have said on conducting the chiar' oscuro in the last section.

In this manner every colour will be harmonised; and, without occupying further space in giving examples of all the prismatic colours and their harmonies, we may sum up the whole by saying, that every principal colour will have its harmonising colour next it and the contrasting one further from it, and the intermediate space between these two will be occupied by tints neutralised by them together, and in such proportion that each shall predominate as the neutralised tint approaches to either, that is, that next to the harmonising colour it will predominate, and, *vice versa*, next to the contrasting colour it will be strongest.

But although a right understanding of the principle of harmonising any one colour is of the greatest importance in giving brilliancy, or whatever other effect may be required, it is in judiciously combining all the colours in a picture, and contrasting them in the most agreeable and scientific way, that a fine general effect can be produced.

In selecting the colours of a picture, and disposing them according to the most harmonious arrangement, those colours which we have already described as being most nearly allied to light, should of course occupy the places where the light is most powerful, and as nearly as possible in the order of their power of illumination; that is to say, that the yellow should follow the white, orange the yellow, red the orange, &c. and should thus form the colours of the principal mass of light,—while the blues, blacks, crimsons, and other colours, which from their depth are fittest for the shade, should fall, in just gradation, into their places, according to that arrangement, and also with a reference to their office of contrasting colours to those in the principal lights, and thus complete the harmony of the whole. Although the contrasting tint of any given colour, (at least of those which belong from their brilliancy to the light,) may in general be most appropriately placed in the shade; yet if not too intense for full light, and thus to injure the breadth of the chiar' oscuro, it may also be admitted in the light.

The shadows of those objects in the principal light (which will be necessarily very delicate,) will also be found useful for aiding the harmony of the colours of which the mass may be composed; thus the white will have delicate grey for its shadow, which will in this place be a sufficient contrast; the yellow, which we have supposed to be placed next it, may, along with its shadow, be so artfully interwoven into the white and grey, as to make a full harmony in this part; the orange may either constitute a part of the shade of the yellow, or may be a distinct object, (in either case the effect as to the arrangement of colour will be the same), and will prepare the way for the red in all its gradations. The sky and background will also be found powerful auxiliaries in harmonizing the whole; thus a grey cloud may be opposed to the white object, which may gradually resolve itself into blue to form the contrast of the yellow, while objects of bluish and more vivid green, with their respective shadows, will contribute to the contrast of the orange, red, &c. The objects in shade having the power of their colours considerably reduced by their situation, will require less nicety in contrasting them than the simple colours, such as yellow, red, &c.; but all broken tints, such as grey, brown, dull greens, and the like, may be contrasted if occasion require, without the intervention of a harmonizing colour, and the effect will be perfectly agreeable and harmonious; but if strong and vivid, a direct contrast, as of red and green, or of blue and yellow, will be harsh and painful to the eye, and must at all times be avoided.

The contrast of black and white seems the only exception from this rule, and when the subject admits of its introduction, is often productive of a most agreeable effect.

In the colouring of a picture, it must ever be kept in mind, "that fine colours do not constitute fine colouring;" and by the principles which we have just laid down, it is obvious that much power, brilliancy, and force, may be produced with a comparatively small portion of actual colour, by the judicious opposition of the several tints; thus grey (composed, for instance, of a mixture of black and white) will appear a good blue if contrasted with yellow, whereas if contrasted with blue it will only appear a dull grey,—a dull green will acquire brightness and force if contrasted with red,—an impure yellow will become brilliant and powerful by being opposed to blue; and so on of every possible mixture of colours. By the judicious application of this principle, any defects, either in the general tone of a picture, or in any particular part of it, may be easily detected and corrected; for if any particular colour be found too predominant, as much of the contrasting colour as will be sufficient to correct the error may be introduced; thus if green be too prevalent over the work, red, or its kindred colour brown, may be thrown in as occasion may require, either in the lights, or more particularly in the shadows, and so on with the rest. Much of the pleasing effect of a picture depends on the due equilibrium between the warm and cold colours, (the former consisting of those tints that are allied to yellow and red, the latter to blue, green, black, &c.) and as coldness is one of the greatest defects which a picture can have, too much attention cannot be paid to guard against this extreme. In *toning* a picture, its character, as to warmth or coldness, will be equally influenced by the colouring of the shadows as of the lights; and if the shadows are not warm, all the warm colours that can possibly be admitted in the lights, will only produce harshness and discord; in general, therefore, in order to avoid either extreme, it will be safest to make the shadows of warm tints only, and throw in a few dashes of cold colour in proper places, and of this very little will be necessary to bring the work to a due state of harmony. But as rules of themselves can do little good, we earnestly recommend to those who desire a true knowledge of this subject, to consult the works of the best masters,—to examine their mode of practice,—and to endeavour to trace the principles by which it has been regulated. In prosecuting the subject of the harmony of colours, we recommend to the perusal of the student two works, viz. "*The Natural system of Colours*," by Moses Harris, and Gartside's "*Essay on Light and Shade on Colours*;" the former is chiefly remarkable for the two diagrams of the contrast of colours which it contains, and the latter is worthy of notice for the figures illustrating the various harmonies, to both of which works we have to acknowledge our obligations.

We have thus presented to our readers certain fixed principles of colouring, the application of which will be found eminently useful in producing harmonious arrangement, as well as in discovering and correcting defects. By rightly understanding them, and thoroughly digesting them, the painter will acquire a delicacy of perception and feeling with regard to this part of the art, by which his genius may indulge in the boldest combinations, without infringing on the laws of harmony, and soar aloft far beyond the sphere of influence of any other rules than what are dictated by his own sensibility. We shall now conclude this part of our subject with a quotation from Sir J. Reynolds, which, though suggested by what we have said on the laws of colouring, the truths it contains hold with equal force in every part of the art where genius and taste can be called into exercise. "By whatever strides," says he, "criticism may gain ground, we need be under no apprehension that intellectual energy will ever be brought entirely within the restraint of written law; genius will still have room enough to expatiate, and keep always at the same distance from narrow comprehension and mechanical performance. What we now call genius, begins, not where rules abstractedly taken end, but where known vulgar and trite rules have no longer any place. It must of necessity be, that even works of genius, like every other effect, as they have their cause, must likewise have their rules; it cannot be by chance that excellencies are produced with any constancy or any certainty, for this is not the nature of chance; but the rules by which men of extraordinary parts, and such as are called men of genius, work, are either such as they discover by their own peculiar observations, or of so nice a texture as not easily to admit being expressed in words. Unsubstantial, however, as these rules may seem, and difficult as it may be to convey them in writing, they are still seen and felt in the mind of the artist; and he works from them with as much certainty as if they were embodied, as I may say, upon paper. It is true, these refined principles cannot be always made palpable, like the more gross rules of art; yet it follows not but that the mind may be in such a train, that it shall perceive, by a kind of scientific sense, that propriety which words can but very feebly suggest."

In order more fully to illustrate the principle of the contrast of colours, we have given at Plate 59. a scheme of the prismatic colours, and a few of their combinations arranged in a circle, in such a manner as to exhibit each colour and its contrast on opposite sides: Thus A is red, its contrast green is at B; C is blue, its contrast orange is at D; E purple, its contrast yellow is at F. The intermediate spaces in the circle are filled up with tints composed of the prismatic colour on each side, and the contrast of each will be found in the same manner as the primitives above described;—thus the purple-red is contrasted with the yellow-green; the green-blue with the red-orange, and so on of the rest. We have judged it unnecessary to colour the figure, as the names as marked on the plate are sufficient to explain it. The nomenclature of the colours, as well as the construction of the diagram, we have taken from the work of Harris above-mentioned.

Sect. V. *General Observations.*

Although the great excellence of a work of art consists infinitely more in the elevation of thought, the taste and genius of the painter, and the intellectual operations which result from them, than on the mechanical dexterity and skill with which his conceptions are expressed; yet as the illusion produced will be perfect in proportion to the correctness of representation of the various appearances of bodies, according to their character and the texture of their surfaces, whether rough, smooth, hard, soft, opaque, or transparent, &c. the beauties which depend on execution, or *handling*, as it is called, must not be overlooked.

The style of handling, and the management of the details, will also be regulated by the character of the work, or the sentiment which its subject should inspire: thus a picture representing Venus and the Graces must be treated with more delicacy and softness of touch than the representation of a battle, triumphal procession, or the like; and the accessaries and details of a historical or allegorical composition, such as armour, furniture, back ground, &c. will require a different style of execution from the accompaniments of a merry-making, conversation scene, and such subjects as the Dutch and Flemish masters delighted in. In a historical work, every thing must tend to the elucidation of the principal action of the piece, and to impress upon the spectator feelings suitable to the subject, while those accessaries which are to mark the time and country in which the event happened, and the circumstances which attended it, as well as the quality and condition of the persons, will be introduced, as to light and shade, situation, and style of execution, with so little ostentation and obtrusiveness, as to be useful matter of illustration, without absorbing the attention and interrupting the train of sentiment; thus the feeling of horror excited by Count Ugolino and his sons starving to death in prison, must not be disturbed by the dexterity and *smartness* of execution of the chains with which they are bound, or of the walls of the prison in which they are immured. All trifling details and circumstances, which detract from simplicity without affording illustration, are impertinent, and must be scrupulously rejected; of this description are the folds of the table-cloth in Leonardo da Vinci's Last Supper, and the dog gnawing a bone in Paul Veronese's picture of the same subject. Even horses and other animals will require, in the grand style, a mode of execution totally different from that of a professed cattle-piece; and if we substitute in imagination, for instance, in the cartoon of the sacrifice at Lystra, a cow painted in the best style of P. Potter or du Jardin, it would be obviously highly injurious to the effect. On the contrary, in those conversations, merry-makings, and other scenes of familiar life, as well as in fruit and flower-pieces, and other subjects of still nature, the professed aim of which is only imitation, the utmost attention in every respect to the appearances of nature, as to form, colour, and light, and shadow, is indispensable; and provided due attention be paid to breadth of effect, which forms so powerful a charm in painting, too much attention cannot be bestowed on minuteness of detail in every condition of light, shadow, and reflection.

In composing a picture, whatever the subject may be, the objects which are to be introduced must be well considered as to their form, situation, light and shadow, and colour; and as, in all these respects, distinctness and simplicity are indispensable, the parts will be arranged in masses with due regard to equilibrium, but without the appearance of artifice.

The back-grounds of historical works are also a subject of great importance.

The back grounds and landscapes of Niccolo Poussin, Dominichino, S. Bourdon, A. Caracci, and other masters of that school, exhibit the finest examples of the elevated and generalized style, combining sufficient minuteness of detail, with a greatness of character well suited to the dignity of heroic and historical composition, and embellished with architecture and other elegant accompaniments. In the back-grounds of Titian, besides the colouring, we find the greatest attention to the minute details of nature, but conceived and executed in a style of so much grandeur as perfectly to accord with the feeling and sentiment of the rest, and totally different from the individuality and minuteness of the Dutch school.

The British school, in aiming at breadth and brilliancy, particularly in their historical works and portraits, have in general sacrificed to glare of effect all the beauties of detail which were so well appreciated by the old masters.

This practice, we believe, may be traced to Sir Joshua Reynolds, who, in his search after colouring and effect, neglected those excellencies which depend on form; and from the eminent success with which his labours were crowned we do not perceive, in these respects, any deficiency in his works. But when such high authority is cited for the encouragement of looseness and inaccuracy, constituting a characteristic defect of a whole school, we cannot but regret that the example of Raffaelle and other great masters of the Roman and Florentine schools in history, and of Titian, Velasquez, and Vandyke in portrait, should be so unprofitably rejected, and particularly where no other excellency appears to atone for the deficiency.

In the infinite variety of objects which the painter, in the exercise of his art, has occasion to represent, it is impossible to give very minute rules for handling. In most other cases, we must refer him to the observation of the works of the great masters, and from them he will select what he may conceive most excellent in each; in general a smooth object, such as the carnations of a female, will be best represented by laying on the colour with delicacy; the shaggy coat of a dog will require a rough style of handling, and the rugged surface of a rock or ruined wall will require a suitable treatment, both as to the *impasto* or loading of the colour, and the rough manner in which it is left on the canvas. The handling of the various parts of a picture will also be modified by their situation as to distance and light and shadow; in the distance the objects will be more delicate in their execution, as well as in the strength of their shadows; in the shade they will be painted with thinness and transparency, as more suitable to the character of repose and obscurity, which in this part ought to be prevalent. No part of the execution of a picture contributes more to its agreeable effect than the clearness of its colours, and this depends both on the scientific selection and opposition of the tints, and the dexterity wherewith they are laid on, aided perhaps by the vehicles (or varnishes or other menstruums,) with which they may be mixed. It is not easy to convey by words any very distinct ideas of that in which *clearness* consists; but in general it depends very much on the expertness and freedom in laying on the colours, and avoiding all unnecessary blending them, so as to injure their purity and distinctness.

The process of glazing is another important operation, by which clearness and harmony will be produced; it consists of laying a transparent colour over another, so as to alter the tint both in depth and clearness, and perhaps to make a total change on the colour,—as, for instance, if over a tint of vermilion a glazing of lake be laid, it will produce a very deep crimson; if over a tint of yellow, a blue, a deep and clear green will be produced, and *vice versa*, from the opaque colour shining through the transparent one; and by this process tints will be produced that no combination of colour laid on at once could equal in brilliancy, clearness, or depth. We shall afterwards enter more fully into detail on this subject.

Chap. II. Practice of Painting.

Having thus given a view of the principles of the art, we shall now proceed to the practical part, in which we shall comprehend the various processes employed in the different modes and departments of Painting and Drawing.

Sect. I. *Of the Outline.*

As some of the most essential characteristics of objects in nature depend on their form, correctness of outline constitutes one of the qualities most indispensable to truth of representation in painting, both with respect to the several parts of an object in their relation to one another, and to the proportion and situation of the several objects of which a work of art may be composed, whether in drawing from nature or in copying the works of others.

Although, by long practice, the eye may acquire great accuracy in the delineation of objects, without the use of any particular method, yet as we conceive that the art is sufficiently difficult, even with all the assistance which can be derived from mechanical rules, we have no hesitation in recommending them where they may be useful.

Whatever may be the nature of the subject, or the scale on which it is executed, correctness in the proportions of the several parts must be always kept in view; and although it is usually recommended to beginners to commence with detached parts, eyes, noses, &c. we conceive that entire objects, whole figures, and the like, will be more advantageous for his study, as the difficulty is not so great in doing small parts, as to acquire the faculty of calculating the relative situations and proportions, so as to form an agreeable and correct whole. The model that we would recommend, at first, ought certainly to be as simple as possible; if a figure, he may perhaps begin with the head, and as the size of it will regulate the proportions and situations of all the other parts, he will calculate it with such accuracy, that it shall correctly fill up the space allotted for it. Thus having determined the space which the proposed figure shall occupy on the paper or canvass, and found out by careful measurement the proportion which the head bears to the rest of the body, according to its perspective appearance as viewed from the point of sight, he will divide the space on the paper allotted for the figure according to this calculation, and mark in the situations of the most prominent parts of it; for instance, the whole length of the figure may be seven times and a half the length of the head inclusive; accordingly, the space to be occupied by the figure will be divided into $7\frac{1}{2}$ equal parts, the first of which will be the place of the head, the second will perhaps be the lowest part of the pectoral muscle, the third may correspond with the situation of the spine of the *ileum*, and so on with the rest; the breadth will be ascertained by the same process; the distance from shoulder to shoulder may be twice the length of the head, and if the space is greater or less the difference will be ascertained by dividing it till it be accurately found, whether a half, quarter, eighth, &c. and, by this minute subdivision, the smaller parts which occupy the places between those cardinal points will also be found. The relation which the objects bear to each other, whether standing perpendicularly under or more or less to a side of any given point, must likewise be carefully measured, and, in order to assist the eye in this, a plummet may be used, and even the pencil held vertically towards the object will be found of great use. Having thus gone through the first process of the outline, which must be considered only as ascertaining the situations and proportions of the different parts, the more minute parts may then be taken into consideration, and the form of every individual part in all its intricacies and convolutions may then be proceeded with; and here the correctness which the eye will acquire by practice may be safely trusted to. We are aware that, to the beginner, there is something very repulsive in all this calculation and measurement; but as correctness cannot be obtained by any shorter process, and as habit will render it easy, and pleasant, and satisfactory in its results, the advantages which it offers must not be sacrificed to indolence and carelessness.

The character of objects, as to form, depending as much on the proportion of the parts to one another constituting a whole, as on the closeness of their resemblance separately considered, correctness in this respect must form an object of particular attention; in the human figure, particularly, this is strikingly obvious; and if we consider the great diversity of character existing among the antique statues, and arising from some minute points of difference in the proportion of their parts, which only this process of calculation can point out, nothing farther need be said in its recommendation.

This principle is equally applicable to every species of objects, whether figures or animals, landscape, flowers, &c. and where correctness of delineation is required, is in all equally indispensable.

The style of outline must always be accommodated to the character of the object represented; so that besides, correctness in point of form, as much of the other qualities of bodies must be given as the nature and capabilities of the materials will admit; and although experience, and observation of the practice of the best masters alone, will point out the manner of doing it, yet, in order to avoid that defect called "*manner*," he must exercise his sagacity in comparing what he sees in art with the appearance of nature, and thus form a style to himself.

Although freedom and spirit in the outline are likewise very desirable qualities, all premature attempts in this respect should be discouraged, the student satisfying himself with representing in the best manner the forms and surfaces of objects, and he will acquire by practice due facility and *masterliness* of execution without seeking it, for, by endeavouring to avoid the defect of stiffness and formality, he may fall into the other extreme of affectation and manner.

Sect. II. *Of Drawing in Chalk.*

In making sketches from nature, and, above all, in the study of the human figure, or what are called academy figures, where form and effect only are required,—chalk, whether black or red, is most convenient, and is most generally used.

The outline is usually made out with charcoal cut neatly to a point, and as it adheres but loosely to the paper, it may be corrected, where defective, by dusting it off with a handkerchief, previous to making the necessary alterations.

The manner of shading the object will depend much on the paper on which it is drawn, whether white or tinted, (or what is called crayon paper,) the latter of which, both in point of expedition and effect, is to be preferred. In the tinted paper, (which ought to be delicate in its colour, and not too deep,) the colour of the paper will represent the *middle tints* or more delicate shadows, the lights will be produced by touching them with white chalk, and the deeper shadows with the crayon or black chalk, according to the necessary depth.

When the work is executed on white paper, of course every degree of shadow will be done with the black chalk: but the difficulty of producing a proper effect is much greater on this material than on the tinted paper; besides, as in the latter the tint of the paper itself forms a great part of the shade, much labour and time are saved, and the effect produced is, for all purposes of study, equal to the other method.

When the outline has been made out with sufficient correctness on the tinted paper, the lights and shadows will be laid in with the scrapings or filings of the black and white chalk, blending them with the stump carefully into the middle tint, and cautiously guarding against the black and white coming in contact, which would produce a tint quite out of harmony with the rest of the work. When the great masses of light and shade are thus filled up, their strength will be respectively increased, by working the several parts up to their proper effect, with the point of the chalk or crayon, so as to form a smooth tint.

The stump consists of a piece of chamois leather, (and sometimes of paper for more minute parts,) rolled up and cut at both ends to a point, and is used by dipping it into the powdered chalk, and thus applying it to the paper; any deficiencies in the smoothness of the surface will be easily supplied by touching it up with the point of the chalk.

In working on the white paper, the black chalk is also applied by the stump in the manner we have just described; and any errors in form, or strength of shadow, are corrected by erazing the part with a piece of the crumb of a loaf squeezed to a point between the fingers.

The appearance of the shadows produced in this way will be more or less smooth according to the grain of the paper and the quality of the chalk made use of, and the lines and touches will be so united as to give the effect of a uniform tint; but another manner is sometimes adopted, called hatching, whereby the shadows are produced by lines running parallel to each other, possessing more or less curvature, according to the convexity of the object, and crossed, where greater depth of shadow is required, with other similar lines, at certain angles, like the work of a line engraving. As this manner is much more difficult, principally from the attention necessary to give the lines a proper direction, and as it is attended with no advantage in point of effect over the other, we would certainly recommend such a style as would leave the student perfectly unfettered by any restrictions in this respect.

We have hitherto only made mention of black and white chalks, which are superior both as to pleasantness of execution and depth of effect,—but the same processes may be applied to the red chalk, with all the advantage that the difference of colour and greater softness of the material will admit.

In academy figures and other subjects, a union of both the black and red chalks is introduced with agreeable effect, by laying in all the shadows with the red, by means of the stump, and touching up the hair, and other parts where greater depth of shadow is required, with the black chalk; and this, if well managed, has a very agreeable effect. If done on a tinted ground, the white may also be introduced with advantage.

Sect III. *Of Drawing with Indian Ink, Bistre, &c.*

In Indian ink, bistre, or water-colour drawings, the outline should be made out carefully with the black-lead pencil, or, for slighter works, with a pen and ink, regulating the strength and darkness of line according to the supposed distance of the object, and its condition with regard to light and shadow; thus, an object placed in the light will be touched with a more delicate though firm line than that in shadow, and in either state with firmness and decision, as well as attention to detail, both in the foreground and in the distance; and the slighter the work is intended to be, in point of light and shadow, the more necessary will the strength of outline be to the effect. The shadows may be filled in, taking first the large masses and gradually the more minute parts, according to the degree of finishing which it is intended they shall have. The best models of style for this manner of drawing, under which we include all drawings executed in one colour, will be found in the sketches of the best masters, or in the imitations of them which have been published, both in chiar' oscuro, like the wood-cuts of Ugo da Carpi after Raffaelle; of Zanetti after Parmeggiano, or in etched outlines, with washes of mezzotinto or aquatinta, like Rogers' publication of the drawings of the Italian and Dutch masters; the *liber Veritatis* of Claude Lorraine, by Earlom; or Mr Turner's *liber Studiorum*, which last, both in conception and execution, forms the most perfect specimen of style in landscape ever published.

Sect. IV. *Of Water-Colours.*

In no part of the art is the practice of its professors more various than in painting in water-colours. We shall therefore restrict ourselves to giving a general view of the subject, without recommending any particular mode as superior to the rest. Although it does not possess the power of effect, or even the permanency of oil-colours, it has been brought to great perfection within these few years by the artists of the English school, principally in the department of landscape.

The colours used in water-colour painting are prepared in cakes, and rubbed down when wanted upon a stone-plate with water, and laid over the paper, more or less diluted with water, according to the depth or delicacy of the tint required, and, in general, no mixture of white or other opaque colour is admitted; they are perfectly transparent, and modify each other, by being washed one upon the other, according to the effect intended, whether of depth, warmth, coolness, brilliancy, or freshness, &c.

Whatever may be the subject of the picture, the colours, both of the light and shadow, will be laid in in a broad manner, leaving the lights so delicate as to admit all the variety which they may require, and avoiding in the shadows every thing that may tend to injure the warmth of the general effect; if the work consist of a groupe of figures, with their accompaniments, the carnations will be tinted with a warm flesh colour, and in the shadows with a warm grey, and their reflexes with colour approaching to orange; a suitable variety, and agreeable clearness and coolness will be given to the shadows by a few raw greys, approaching to blue, delicate greens, and other cold tints, and they may be laid on either in light washes, carefully blended into the tint below, with a clean hair-pencil and water; or by patching, by repeated crossings, the one tint over the other, the shades of the draperies will each be shaded with a tint suitable to the colour of the object, and likewise blended with softness and delicacy into the tint next it, by means of the wet pencil. The background and other accessaries will be executed with a broad touch, each object according to its colour, but always kept in subordination to the principal parts of the piece; and the arrangement and contrast of the colours of the whole work, as well as the means for giving clearness and beauty to the individual parts, will be regulated by the principles which we have already laid down under the section *Colouring*. As this subject can receive little minute illustration by words, we can only recommend to our readers to consult the works of the best masters, and, by the assistance of the hints which we have given, they will perhaps be enabled to discover the principles by which they were guided, and direct their practice accordingly.

In landscape-painting, the sky being previously damped with a sponge, and as much of the dampness as possible taken off with a clean towel, or sheet of blotting-paper, the several tints will be laid on with a large pencil, and blended carefully while it is damp; and, when dry, any defects, stains, or marks, will be taken out by rubbing it well with the sponge; it may then be touched up, according to the effect required, with all the necessary variety of colour.

The tints of the landscape, both of the light and dark parts, will then be put on; the greens of the light parts of the trees will be blended with the greys, which form their shadows, while they are wet, and thus more delicacy and softness will be given to them than if they had been laid on separately.

When the dead-colouring is finished, the more minute parts will be proceeded with, touching each object in the style best suited to represent its character.

The earlier water-colour painters made use of what was called a neutral tint, with which the whole effect and details of the picture were made out, and washed the colours upon this; this method is good enough for slight drawings, and may be practised with advantage by beginners; but for highly finished works it is not well adapted, as the monotony arising from the shadows of every object being done with one colour, gives a feebleness, poverty, and coldness to the effect. We have, therefore, no hesitation in pronouncing our preference to the clear and forcible manner at present practised by the best masters of the English school, who, by adapting the tone of the shadow to the true colour of each object, give truth and vigour to their works which no neutral tint can equal. In oil-painting the effect of the work is greatly aided by the facility with which the surfaces and texture of bodies may be represented by the *impasto* of the colours, which, by being laid on with proper degrees of smoothness or roughness, as we have already mentioned, contribute greatly to the truth of effect; in water-colours no such advantages are afforded, as the colours are only washed over so as to tinge the paper, without producing any change in the surface as in oil. In order to remedy this defect of the transparent water-colours, various methods have been resorted to, such as combining opaque colour or distemper along with it, taking out the lights from the darker shades below by rubbing them off with bread, and by making use of paper of a rougher and more absorbent texture than the common drawing-paper, all of which processes we shall describe. The transparent colours will be rendered sufficiently opaque for the purpose we have mentioned, by mixing them with white, and they must be used sparingly, in order not to take off the appearance of a water-colour drawing; the best white is what is sold in cakes, under the name of *constant white;* the flake white, and other preparations of lead, having a tendency to turn black, ought never to be used in water-colours.

Of Painting. In order to give the fullest effect to the lights touched with the opaque colours, the ground or middle tint in which they are to be put, should be made also semi-opaque, by mixing a little of the white with it, at the same time washing on the tint thinly, so that the appearance of this may not differ from the rest; and thus the light and the dark will easily combine and produce an agreeable effect. This would not be the case if the touches had been put on the transparent groundi. The whiteness, or *chalkiness* as it is technically called, which cannot, in the first instance, be avoided in opaque or distemper painting, will thus be less conspicuous, and may be wholly corrected by working over it again with transparent colours; by which means a depth and freshness may be given little inferior to oil-painting. The effect of air or haze in the distance, will be greatly improved by thin semi-transparent washes of white, ultramarine, smalt, and other semi-transparent colours, which will modify the original colours in a manner that the common water-colours alone could not; by giving substance, as well as delicacy of colour and shadow in the distance, and surface, strength of light and shadow, depth, and clearness in the foreground. The lights of a picture may also be brought out with much sharpness and force, without the opaque colour, in the following manner: A tint being laid over the object equal to the strength of the second light, and having received the effect which may be required in the shade, a pencil with clean water will be touched over it where the bright lights are required, and they will come out full and distinct, by rubbing them with the crumb of a loaf; this may be done with advantage in every part of the picture; but in the foreground particularly, where strength and richness of surface is required, it will be found of great use; when the lights are taken out, they will be filled in with suitable tints, not over the whole, but only where the colour has been taken off.

The lights may be also preserved on the paper with the greatest sharpness, by laying on, in the parts where they are required, a preparation which will defend the paper from receiving the tints which are washed over the rest; this is called stopping up the lights. If, for instance, in a sky, great sharpness of touch were required on the clouds, perhaps also the sun or moon, or in any part of the picture, a light object seen against a dark one, which, from some peculiarity of form, or other circumstance, it would be tedious or difficult to leave out, the parts intended to be left light, might be covered or *stopped out*, and the tints of the parts round about might be put on freely over these stopped up objects, and when the whole had received sufficient effect, the preparation might be removed, and the parts that were stopped up would appear quite white, and might then be washed down to any depth of shade or colour requisite. For this purpose of stopping out the lights, many different substances have been used, such as the yoke of an egg touched on with a hair pencil, and removed with Indian rubber, or a mixture of white lead and mastic varnish, to be taken off with oil of turpentine, or spirit of wine rubbed over it with a brush; but the most convenient of all substances, for this purpose, is pipe-clay mixed up with water to a proper consistency and touched on in the usual manner; it forms a sufficiently strong defence against the colour, and is easily taken off by rubbing it with the crumb of a loaf or a piece of Indian rubber.

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Arts of Design.

The texture of the paper is also a material consideration in water-colour painting. In general, unless with the assistance of those auxiliary processes which we have just mentioned, there is a flimsy and unsubstantial appearance in the effect both of the lights and shades; this defect will be greatly removed by the use of a rough paper, the surface of which will give richness and depth; a paper, called *improved* drawing paper, has for a considerable time been in use among our artists, which gives great force to the effect of the work; and even the common drawing paper, if sufficiently thick, may be greatly improved by soaking it for some hours in water, and thus taking out some of the size with which it is prepared; a very agreeable roughness will be given to it by rubbing it pretty hard with a spunge and water after it has been soaked; it will thus take on the colour more agreeably, and the absorbent quality which it acquires enabling it to take up a greater quantity of the colour, without appearing darker, gives a solidity to the several washes which no tint without this preparation could have.

The pigments chiefly used in water-colour painting are, yellow-ochre, gamboge, Indian yellow, brown pink, Indian red, burnt ochre, vermilion, lake, burnt terra di Sienna, burnt umber, indigo, sepia, Vandyke brown, constant white, ultramarine, smalt, to which may be added a number of very bright yellows, blues, &c. which have lately been introduced amongst us from France. From this catalogue the student will select what he finds most suitable to his style. Our limits do not permit, and it is not the plan of this essay to give minute instructions for making up every variety of tint, or to direct all the details of an art of so much difficulty; we shall therefore only give a few general hints, which practice and observation will enable the student to improve. The greens may be composed of different proportions of gamboge and indigo, and by adding to these, browns or reds, terra di Sienna, burnt umber, sepia, or burnt ochre, an endless variety of green tints may be produced; the greys or neutral tints for the shadows may be composed simply of Indian red and indigo, or by indigo and lake, with the addition of burnt umber, sepia, gamboge, or other yellow or brown colour to take off the rawness of the purple; but, in this, the discretion of the artist must determine. Sometimes a better effect in point of clearness and brilliancy of colour will be given by washing one colour over another when the first is dry, particularly if that put on first be rather opaque, and the last very transparent; but in these infinite varieties of composition of colours, no verbal directions can be of much use.

When a water-colour picture has been brought up to a considerable degree of effect, and any harshness or other defects appear that require to be remedied, the sponge will be found of great service in softening it or entirely effacing the error; a large quantity of water should be used in order to take away every thing loosened from the paper; and for this purpose, in cases of nicety, water may be poured over and washed off with a flat tin brush. One of the most delicate and difficult things to manage in a water-colour picture is the sky, and as it is hardly possible to give every part at once the proper tone of colour, softness, or other effect that it may require, it is often necessary to apply the sponge and water, and if the paper be sufficiently thick, the alterations may be easily made, and even the whole sky may be washed out, without injury to the paper.

In order to make the colours work more freely, and to take off the greasiness which sometimes is very troublesome on the paper, a very small quantity of ox-gall mixed with a considerable qnantity of water washed over the paper, will render it perfectly pleasant to work upon, and it will also be advantageous to use this mixture for rubbing down and working the colours with. This gall is sold in the shops, but it may always be obtained from the shambles, and prepared by merely boiling it to dryness, or drying it in a moderately heated oven, the temperature of which will neither decompose or change it by too powerful a heat, nor permit it to putrify by the opposite extreme; a small quantity of it in this dry state, equal to the size of two pin-heads, will be sufficient for a tea-cupful of water; it may be also kept many years in the natural fluid state, by mixing it with a little spirit of wine and alum, and preserving it in a phial well corked, and a drop or two taken out for use and mixed with water as required.

Before beginning to the picture, the paper should be pasted upon a drawing board, which is done in the following manner: The paper being damped on both sides and allowed to lie for about ten minutes, it is then placed on the board; for about the breadth of an inch all round it is folded back, the water that may remain upon it is to be wiped off that it may not weaken the paste, which is now to be put over this part of the paper as well as the part of the board that it is to adhere to; it is then turned down and pressed strongly till it stick closely, and the whole surface may then be well scrubbed with the sponge, and when dry is ready for use. Glue is perhaps better for this purpose than paste as it keeps much longer, and may be depended on more surely than the other for adhering to the paper.

It will be observed that no paste or glue must be put on the part of the paper on which the drawing is to be done, as it would be fixed firmly to the board, and would not come off without doing at least much injury to the picture,—it is only round the edges; and the drawing is cut off when done, and the paper which remains may be cleaned off afterwards by soaking it in water and scraping it with a knife.

Sect. V. *Of Miniature-Painting.*

Miniature-painting, a mode of painting portraits on a small scale, is usually executed in water-colours upon ivory, though sometimes on paper or Bristol cards; when the latter substances are used, the work is conducted like any other water-colour drawing, but, when done on ivory, the preparation and whole process are different.

The ivory used for this purpose is to be had at the shops, sawn into thin plates. It must be first scraped with a three edged sharp instrument called the scraper, the same as that used by the engravers and described amongst the engravers tools; when the surface is made sufficiently smooth, and the marks of the saw entirely effaced, the ivory is then rubbed with pumice-stone finely pounded and sifted, and applied with a piece of leather or felt; this last operation is necessary in order to take off the gloss and fine polish communicated by the scraper, and to enable it to receive the colours with greater readiness.

The outline is carefully made out with a delicate shade of Indian red, and the different shades of the face are filled in with a neutral tint composed of Indian red, indigo, and burnt terra di Sienna, and these are again enriched and deepened by an olive tint composed of indigo and burnt terra di Sienna; a delicate wash of Indian red is the ground-work for the warm tints of the flesh, and these are varied and harmonised by the introduction, in proper places, of touches of carmine, ochre, and raw terra di Sienna. As the water-colours adhere but loosely to the ivory, when an alteration or correction is judged necessary, it may be made by scraping off the colours with a lancet or sharp penknife, or, if the correction is too large for this, it may be washed off with a hair pencil and a little clean water. The back ground is *floated in* with a full wash of a suitable colour, and, according to the practice of some artists, mixed with a small portion of constant white, and the various tints required are stippled, *(or dotted,)* and hatched with the hair pencil. The colours for the draperies are mixed with a suitable quantity of constant white, which will give greater solidity to the appearance of the various substances; they ought also to be floated over the part in considerable quantities, and when dry they are touched up with lighter and darker shades of their own colour according to the effect proposed; light or white draperies, or other objects of this description, are heightened on the lights with constant white, at least with the tints rendered opaque by mixing it with them.

In miniature-painting the hair ought to be very highly finished,—this will give more freedom and spirit to the rest; and in every part delicacy and purity of the tints are necessary to fine effect on so small a scale. Stippling gives great richness to the effect of a miniature, but should be introduced with caution, and used sparingly, otherwise it has a tendency to give a heaviness to the whole. In order to give greater power to the effect, some artists, after having completed the head, varnish it, and finish the rest of the work in oil-colours; but although this process gives greater durability to the colours, it detracts, in some degree, from the delicacy expected in this mode of painting, and is not very generally made use of. In setting up the model, it is necessary to introduce the light in such a manner that the shadows should take the most agreeable forms, and be free from harshness and sudden transitions from light to dark, as the same force of chiar' oscuro is not admissible in small subjects of this sort, that are necessary on a larger scale. The colours (which are usually the common cakes) should be thinned with a solution of gum-arabic, preserved by the addition of a little spirit of wine; and it will be found to work with greater ease if a little of the solution of ox-gall be added to the water made use of for thinning the colours; the method of preparing the ox-gall we have already explained in the preceding section; and a very minute portion of it will be sufficient for a wine-glass full of water; the gall may be also preserved in the fluid state by pouring into it a little spirit of wine. As ivory has frequently a yellow colour, which it is desirable to discharge, before beginning with the preparation which we have described, it may be bleached by simple exposure to the sun; others whiten it by means of boiling it in fuller's earth.

The ivory ought always to be covered on the back with a piece of clean white paper, in order to obviate the inconvenience arising from its transparency, and give full brilliancy to the colours. When the work is found to be deficient in warmth in the general tone, some artists lay over the back of the ivory a coat of some warm colour, which often gives a very agreeable tone over the whole, as the transparency of the ivory permits it to shine through to the front.

As water-colours, in general, are somewhat evanescent and easily injured by the action of light,—works, where delicacy of colour is wanted, and particularly miniatures, should be kept as little as possible exposed to its effects. When miniatures are finished, they should be secured from injury by covering them with a convex glass, fixed all round with *gold-beater's skin*.

Sect. VI. *Of Distemper, or Opaque Colours.*

This mode of painting was much used by the later Italian and French artists, and is still used for theatrical scenery and other interior decorations, where force of effect is wanted, and where the circumstances under which it must be seen render it necessary that it should have no gloss like oil-painting.

It is called Distemper from the French (*à detrempe*) body colour, size colour, or opaque, and is executed, as the reader may have already anticipated, with colours ground in water, and mixed with size or weak glue, mucilage of gum-arabic, isinglass, or other gelatinous substances, and differs from the transparent-colour painting principally in this, that in the latter, in order to produce a light shade of any colour, it is diluted with water; in the former it is made lighter by mixing it with white; in the one the colours are put so thin on the paper that it is merely tinged with them, in the other they form a thick body on its surface.

The colours which are used in distemper consist of all those which we have named as useful in transparent water-colours; it must be observed, however, that many of those colours being expensive, and too fine, on that account, for the ordinary purposes to which distemper-painting was commonly applied, particularly considering the quantity in which they must be used, economy must direct in the selection of the pigments, according to the quality of the work. For the coarser purposes of distemper there are also several other pigments which supply the place of more expensive ones. Good whiting, or prepared chalk, for white; Dutch and English pink are very bright yellows; rose-pink will supply the place of lake; these three are not very permanent, being only whiting dyed with different vegetable decoctions; red and orange-lead are very bright, and supply the place of vermilion; and blue verditer is a colour almost as bright as ultramarine.

The colours are mixed up with the size to a proper consistency, and laid on with the brush in the usual way. The most convenient sort of size is glue weakened with water till it be no more than sufficient to bind the colours; it will, in that state, continue fluid, without congealing, at the mean temperature of the atmosphere, which gives it a preference over isinglass and some other substances in use.

There is an inconvenience to which it is subject, which gives much trouble to those who have not much experience in working it; which is, that the colours when wet are much darker than when they have dried; it is often necessary, in order to know what will be the appearance of any tint, to put a little of it on a piece of paper, and dry it at the fire: this will be of much use to those who are not well acquainted with the nature of those changes which the colours undergo in this way.

Although distemper-painting gives a very fine and delicate effect to the distance of a picture, it is by no means so successful in giving the deep tones necessary to the nearer parts, from the chalkiness which we have mentioned in our section on water-colours. This may be obviated in a great measure by giving a deeper tone where required with washes of transparent colours over the other; thus a wash of gamboge laid over a green composed of Dutch pink and blue, will give depth and freshness almost equal to oil paint; and the same process may be adopted with many other colours, which the experience of the artist will discover.

Distemper-painting was also much practised, according to the opinion of many intelligent persons, by the Venetian masters, as a preparation or *dead-colouring* for their oil pictures. As this more properly belongs to another part of our subject, we shall discuss it at greater length in the section on oil-painting.

Distemper-painting may be executed either on paper, or canvas, or even on wood; for works of a smaller size, paper is preferable. When canvas or wood is used, they should be prepared with a *priming*, or ground, composed of whiting mixed with a due proportion of size; and if a smooth surface is required, it should be smoothed with pumice-stone and water.

Sect. VII. *Of Fresco-Painting.*

This mode of painting was very extensively in use among the Italians since the revival of the arts, as well as by the ancients. It has generally been applied in the interior decorations of churches, great halls, &c. and was practised by all the great masters of the Italian schools. All the works in painting of Michael Angelo, many of the principal works of Raffaelle, Coreggio, Parmeggiano, &c. as the walls of the chapels, &c. of the Vatican, and the dome of the cathedral of Parma, are executed in this way.

The colours are ground in water, and painted in a ground of wet plaster, prepared from day to day, as the work goes on; the colours form an intimate union with the plaster, and are perfectly permanent: when the whole is dry it is washed over with boiling vinegar, which forms a varnish, and by its chemical action deepens and mellows the whole.

Sect. VIII. *Of Oil-Painting.*

This mode of painting, which has obtained the preference over every other, both from the extent of its capabilities and the ease and convenience of its execution, is an invention entirely modern; the colours are prepared with oil, and the ground may be either of canvas, pannel, oak, or mahogany.

The pigments employed are the same that we have already named as fit for water-colour or distemper-painting, with the exception of whiting, and the colours that are formed by dyeing it, as Dutch and rose-pink, verditer, &c.

The only whites that can be admitted into oil-painting are, white lead, or as it is called in its more refined state flake white, and zinc white; the former being an oxide, or rather carbonate of lead, obtained by exposing the metal to the action of the steam of vinegar; the latter, by the simple calcination of zinc, by raising it to a red heat in a crucible. This latter having very little body, though perfectly durable, is little used in oil; it is, however, we believe, that substance which is used in water-colours under the name of constant white. The yellows are, ochre, raw terra di Sienna, Naples and Dutch yellow, brown, pink, Indian yellow, which is a colour so transparent as to require to be mixed with white or other body colour to give it substance; king's and patent yellow are also bright colours, but are liable to fade and lose their brilliancy, and are therefore not to be used where delicacy is required. The reds consist of burnt ochres, vermilion, Indian red, lake, madder-lake; the the browns, of burnt and raw umber, burnt terra di Sienna, Vandyke-brown, Cologne earth, asphaltum; black, of ivory and lamp-black: cherry and peach-stones, cork and other vegetable substances when charred in a covered crucible, make also excellent black pigments, and may be used either pure, or mixed with other colours for greys, &c. Prussian-blue is the best pigment of this colour for general purposes; but for delicate tints ultramarine must be used, as, from the peculiar action of light on Prussian blue, it invariably becomes green when used in skies or other places where it is required to be light and pure. There has likewise been imported from France lately a pigment called Cobalt-blue, a colour which, though not so bright as ultramarine, is little inferior to it, and may in most cases supply its place, and is much cheaper.

We have thus enumerated the colours that are principally made use of in oil-painting, and the artist will select from them what may best suit his taste and the nature of the subject; in general, the fewer the colours he makes use of, the more easily will he become acquainted with their qualities, and, with skilful management, a great variety of colour may be produced with very few pigments, by the mixing of the colours, and by the processes of glazing and scumbling, which we shall presently describe.

The colours are to be ground in lintseed oil, prepared according to the process mentioned below; but as several of them are of such a nature as not to dry readily, they may be ground either with drying oil at once, or, if with common lintseed-oil, they will require to be mixed with sugar-of-lead or green vitriol, (sulphate of iron,) previously ground with lintseed oil.

The colours in oil-painting are to be made lighter when required by adding white to them, according to the delicacy or other effect intended; and the qualities of roughness or smoothness, &c. will be given both by the tones of colour and by the style of handling in which they are executed.

When any given object is not of the proper tint, it may be modified, either as to tone or intensity of colour, by the process of *scumbling*, which consists in passing over the defective part with another colour, diluted to a state of semi-transparency, with varnish or other vehicle; in this operation the original colour of the object will be allowed to shine through the scumbling, according to the degree of strength or effect required and may be retouched, where the sharpness or force has been injured, with the necessary body of colour. Thus, if any part of a picture, piece of drapery, &c. were too blue, for instance, a thin scumble of a lighter colour may be put over it, but so thinly that the original colour and form of the folds, shall still appear, and it may then be retouched, where the strength of shadow may have been affected by the process. The quantity of white which should be mixed with the colours must depend on the nature of the alteration intended to be made; but in general it may be equal in quantity to the colour mixed with it.

Glazing forms another process of the greatest importance to the painter, by the assistance it gives in producing richness, depth, and harmony of effect. It consists in passing over any given colour, or another tint perfectly transparent, whereby the qualities we have just mentioned may be communicated with the greatest facility; thus the most brilliant yellows, greens, crimsons, or purples, may be produced, and of such force of colour that in no other way could in the slightest degree be imitated. The colours used for this purpose are of course only those that are transparent, as Indian-yellow, brown, pink, gamboge, the lakes, Vandyke-brown, asphaltum, Prussian-blue; and they will be thinned to the due degree of lightness by adding a proper quantity of the *vehicle*.

As glazing deepens the tints of objects, and thus takes away the appearance of air or distance, it must in general be confined to the fore-ground, and objects near it.

In general all objects of the same colour and under the same circumstances as to light and shade, but at different distances from the spectator, have their strength of colour and depth of shadow reduced in the ratio of their distance; but in painting, besides this intensity or delicacy of colour and shadow, the various gradations are assisted in a great measure by the transparency or opacity of the colours, as well as by the processes of scumbling and glazing: thus a distinct shadow of considerable depth, but painted only with opaque colours, (that is, colours not transparent,) or made lighter by scumbling, will appear at greater distance than another not actually so dark, but painted with transparent colours, or opaque ones rendered so by glazing. By a judicious union of *surface* and glazin g in a picture, the texture and relative distances of objects may be defined, even where little difference of colour or strength of shadow occurs; thus, if two objects of the same character, one at a greater distance than the other, be painted with the same colour, but treated respectively, in point of handling and surface, in a manner suitable to the situation and relative distance of each, and if the nearest be washed with a thin glazing of a proper transparent colour, though little alteration be made on the tint, yet, by the clearness which the glazing communicates, joined to the relief derived from the handling, a contrast will be formed with the more aerial tint of the unglazed object, which will make the one recede into the distance while the other will appear near.

The extreme brilliancy and depth of colour of the Venetian pictures, had always induced the belief that, besides the profound science in colouring which that school possessed, they adopted certain processes different from what was generally practised by the other schools; and this idea has been sufficiently confirmed by a more minute examination of their works. We shall endeavour to explain these processes, as far as our observations, and the experiments suggested by them, may be considered as authority, in absence of all written information.

It appears to us, then, that the basis of the practice of the Venetians was the union of distemper or size-colours with oil, and thus combining the advantages of both. It was performed by filling in the dead-colouring and general effect with the distemper, and bringing up with oil-colours the more delicate and minute parts of the work to their proper brilliancy, while, by glazing and scumbling on the size-colours, tints were produced, which, for depth and richness, no process with oil-colours alone could equal.

In order to give the distemper as much body as possible, white-lead must be used instead of whiting, which we have recommended for distemper-painting; and the size made use of must be strong, (in order to be as little altered as possible when the varnish and oil-colours are applied;) the general effect may be filled in with the distemper, and even some of the more minute parts may be worked upon, and all those parts where much of the *impasto* is required may be loaded with it with the greatest freedom. When as much has been done with the distemper as experience may have shown to be necessary, the varnish is applied over the whole picture, and the oil-colours are then introduced. As, notwithstanding every method that can be taken to avoid it, the colours will become very dark by the application of the varnish, it will be found necessary to work many of the lighter parts of the picture, with a body of oil-colours, as if no distemper preparation had been made, but in general scumbling and glazing will be found sufficient; and by these means a brilliancy and depth are produced, and with such expedition as will be truly astonishing; but the limits of each process can only be known by experience in this as well as many other parts of the art.

The oils which are generally used are either nut, poppy, or lintseed; the last, if properly purified, is the best, it dries hardest, and has a good colour.

In order to purify the lintseed oil, various methods are employed; if it be mixed with litharge, in the proportion of about two or three ounces weight to a gallon of oil, and exposed to the light of the sun for a fortnight in a glass-bottle, and shaken occasionally, it will become very pure and colourless, having precipitated a considerable quantity of mucilaginous matter which had been dissolved in it. This is by far the best method of purifying oil, and in this state the most delicate works may be painted with it; and if the oil have been *cold-drawn*, as it is called, or obtained from the seed by simple expression, without the application of heat, nothing can equal it in the qualities to be desired for the purpose. The process may be accelerated by the application of heat, as that of the sand-bath, or of boiling-water, which may be done by putting the bottle containing it in a saucepan with cold water, and allowing it to boil, and the process may be continued according to the strength of the drying quality required; for most purposes an hour's boiling will be sufficient.

Oil may be deprived of its colour by exposure to light and air, without any other mixture; but by this it becomes thick and viscid, and very unpleasant to work with, so that it cannot be recommended in this state.

If a gallon of lintseed oil and two ounces of litharge be well shaken together for a fortnight, and the clear part be separated and mixed with half a pint of turpentine, and exposed for three days in shallow vessels to the light of the sun, it will become perfectly colourless; by dissolving half a pound of frankincense in a quart of oil of turpentine, and adding it to a gallon of lintseed oil prepared in this way, it will form a mixture that will dry in four or five hours. The colours should be ground in oil of turpentine and thinned with this oil.

During frosty weather, snow will deprive the oil of its colour, and render it fit for the most delicate purposes. The snow should be hard, from having been exposed to a cold atmosphere. The oil should be poured over it, and intimately combined with it by working it with a spatula; the oil will be gradually disengaged by filtrating itself through the snow, which retains all the grosser particles and extraneous matter with which it had been combined. The experiment requires several days to complete, and will not succeed but during a continuance of frosty weather, so that the snow may not be dissolved during the process.

Lintseed oil may also be purified and deprived of its colour by pouring into it a little sulphuric acid, considerably diluted with water; if the acid be too strong it will decompose and char the oil, and render it black. The acid may afterwards be separated from the oil by washing it with water, from which it may be poured off for use. The lintseed oil purified in this way has all the appearance of nut-oil, and is often sold as such in the shops.

Drying-oil is made by boiling or heating lintseed oil in a cast-iron pot with litharge, to which some add umber and red and white lead; these communicate to it a very strong drying quality. These substances are put into the vessel along with the oil, placed on a slow fire, and stirred occasionally with an iron-rod or piece of wire. The oil will have less colour, and be equally drying, if it be only kept at such a temperature as raises a whitish scum on the surface without allowing it to boil; if heated too much it is partly decomposed, and seems even to lose part of its drying quality. When it has been long enough on the fire, it may be set aside to let the litharge and other matters precipitate; it may then be poured off for use; and, to separate it more completely from those substances, it may be thinned by a little oil of turpentine. The litharge does not soon lose its drying qualities, and may be used repeatedly with fresh oil as at first.

The only varnish used in oil-painting is mastic, dissolved in turpentine by a gentle heat. As the quality of the varnish depends much on the purity of the mastic, it should be selected with care, choosing only those pieces that are hard and transparent. It should then be bruised into a fine powder in a mortar, and boiled in water to separate all foreign matters that are soluble in this menstruum, and then be poured off, and dried. The powder being put into a bottle, with a sufficient quantity of oil of turpentine, is dissolved by the heat of the sand-bath or of boiling water. It may, if necessary, be passed through a gauze-sieve, in order to clear it from any gross particles with which it is combined.

Copal varnish is also sometimes used; but as it is of a strong colour, besides having other defects, it is not to be recommended.

Vehicles are substances which, having no colour themselves, are used to dilute the paint with, in order to give it more facility in working, or to adapt it to the style or manner of touch which the several parts of a picture may require; thus, some parts may require a full, fat, and juicy touch, others a delicate or transparent, others a thick and well loaded one, according to the appearance of their surface.

The vehicle most generally in use, and which is convenient for most purposes, is called *megilp*, and consists of mastic varnish and drying oil in equal proportions; when mixed up it acquires the consistency of a jelly, and in this state may be combined with the colours in such proportions as the degree of body or transparency wanted may direct.

When a very great body of colour is required, the proportion of the mastic varnish may be increased, and it may also be of a thicker consistency; if a saturated solution of sugar-of-lead in water be added to this, and squeezed up with the pallette knife, it will form a megilp of a very strong consistency, whereby such objects as require it may be touched in a very bold and spirited manner; the water, however, gives a whiteness to the colours that are mixed with it when first laid on, which soon goes off; but to those that are not aware of the change, it will be very troublesome and inconvenient, and be a great source of fallacy as to the true tone of the colour, particularly in glazing.

Bees-wax is often dissolved in the oil to assist the clearness of the colours; this is done by a gentle heat in a glazed pipkin or earthen vessel.

Several other substances, chiefly resins, have been used to give consistency to the colours, as well as to make them very hard, such as frankincense, rosin, and amber; this last, however, is so refractory as not to dissolve without being partly decomposed, and thus assuming a very black colour, which renders it of little use when delicacy of colour is required.

A very excellent vehicle was invented by Mr Ibbetson, to which he gave the ludicrous name of *Gumtion*. It is composed of sugar-of-lead and mastic in equal proportions, ground in lintseed oil upon a marble slab; great care must be taken in grinding that it be made very fine and smooth; the quantity of oil should be such as to form it into the consistency of the other colours; and in this state it forms a most agreeable vehicle, possessing much clearness and transparency, and drying very hard without injuring the purity of the colours; it may be made in a large quantity, and if kept in a vessel covered with water, it may be preserved for a long time; sometimes rosin is used instead of the mastic, but the latter is preferable.

For small pictures, where spirit and boldness of touch are required, the colours are sometimes mixed up with a composition of lintseed oil and copal varnish; the oil should be purified with litharge; the oil and the varnish should be heated separately in proper vessels, and the varnish in this state poured gradually into the oil, stirring it during the process with a small piece of wood or pencil-stick.

These substances, we are convinced, will be found best adapted for the purposes for which we have recommended them; but in order to give the colours as much brilliancy as they are susceptible of, and to insure them against change, the following considerations must be attended to: The changes which take place in pictures, sometime after they have been painted, must, in most instances, be attributed, not to the fading of the colours, but to some partial decomposition of the oil with which they are wrought, by which the brilliancy of the tints becomes often greatly reduced; in order to prevent this, the pigments should be ground with as small a quantity of oil as possible, and thinned to the proper consistency requisite for the several parts of the picture, either with mastic varnish, or megilp, in which the oil is in smaller proportion than the varnish, or in cases where no great *impasto* or loading of the colour is required, with oil of turpentine. When the white-lead is mixed up with megilp or with purified lintseed and mastic varnish in equal parts, it forms a paint which works most agreeably either in this state or diluted with turpentine, dries hard, and is very durable in point of colour; and as all the delicate parts of a picture, where the changing of the colours is most detrimental, must necessarily contain a considerable portion of white, if it be prepared with this, the work will be ilable to little change through time. After a picture has been finished some weeks, a great part of the oil will be found to have come up to the surface, which will have the effect of giving a yellowness to the whole; if this be taken off it will be a great advantage to it, both in point of clearness and durability of colour. In order to do this, it should be well washed with pounded chalk, or fine pumice-dust, and water, with a brush or sponge; and it will become much more abstergent by the addition of a little soap or alkali to the water. Of course the picture must be perfectly dry and hard before being subjected to this process, which must not be continued so long as to take off the colours, or otherwise injure its surface; it must also be done before the glazing be put on. A picture treated in this way will be found astonishingly improved in its appearance, and will not be subject to change afterwards.

Much of the effect in the shadows of a picture depends on the ground upon which they are painted; a dark brown, or chocolate colour, was much used by the Italian masters; the shadows being painted thin and transparent, and this ground shining through, gave an agreeable warmth, a clearness and repose, to the effect. The Dutch painters in general painted on a lightish warm ground; and the clearness which they gave their pictures was greatly improved by this appearing through every part of their works, except the strong lights, which were the only parts of the picture which had any great body of colour.

The painter will use that which he finds most agreeable and suitable to his style; in general we consider the deep-brown to be the best, as contributing greatly to the depth and clearness of the shadows; but in the lights a great body of colour is necessary, and in some places it may require to be painted two or three times over. Sometimes, where brilliancy is required in any particular part, as, for instance, in certain colours of drapery, it may be painted with such a colour as may receive a coat of glazing in order to produce the tint required. Thus a most brilliant yellow is produced by a glazing of yellow-lake or Indian-yellow on a white ground; a blue of ultramarine, and a pink of lake, also on a white ground; some opaque colours, also, as vermilion and patent-yellow, acquire great additional brilliancy by being laid over a white ground.

The substances on which paintings in oil are executed most generally are, canvas, pannel, either of oak or mahogany, plates of copper, or tinned iron, and pasteboard or paper.

For works of great magnitude canvas is best and most easily obtained; it ought to be even and smooth on the surface, and not too close in the texture or fine in the thread. It is prepared by straining it tightly upon a frame, laid over with a brush with a coat of hot size or glue, of such a strength as to remain of the consistency of jelly at the common temperature of the atmosphere; it ought, while wet, to be rubbed down well with a piece of pumice-stone to take off knots and other inequalities of the surface; the rubbing to be performed always in one direction. When this coat is quite dry it will require a second, which is done with the size of the same strength as before, but applied cold; when this second coat is dry it might be fit for use, but it is usual to lay it over with a coat of white-lead ground in oil with a trowel, somewhat like those used by plasterers, taking care to cover the canvas and no more, scraping off all the rest, and making the surface as smooth as possible, which completes the process. As it is desirable that the canvas should continue soft and pliable, a considerable proportion of whiting or yellow-ochre may be added to the white-lead, and as these substances do not dry so hard as the lead, the canvas is preserved for a long time much softer.

Canvas is sometimes prepared with what is called an absorbent ground, which is merely the addition of whiting to the size, as mentioned in the first part of the process of the oil-ground; a little umber, or other warm colour, is commonly added in order to give it an agreeable tint. The absorbent ground is preferred by some artists, as it enables them to use a large body of colour, and likewise takes up all the superfluous oil, whereby the colours are preserved in greater purity. It is, however, difficult to work upon, from the colours becoming thick by the absorption of the oil, and appearing darker when laid on than when mixed up on the pallette.

Oak and mahogany boards are very agreeable substances for this purpose; the pannels should be old, or at least well-seasoned, to prevent them from warping. They may be prepared by laying them over with one or two coats of whiting and strong size, put on with a brush. When dry they are rubbed perfectly smooth with a piece of pumice-stone and water, and wiped clean with a sponge; in this state it has an absorbent quality, but this may be taken off with a coat of oil or varnish. This is the best and most expeditious way of preparing it; but if the wood have been painted before with oil, as old coach-pannel, it must be done with oil-paint, and polished to a smooth surface with pumice-stone and water; and as the oil-paint does not dry hard enough to admit of this operation for a long time, care must be taken that it be in a proper state for it before the smoothing be attempted.

Copper or tinned iron may be prepared for oil-painting by a coat of white-lead ground in oil; or if the surface of the metal be smooth enough, it will do well without any preparation.

Paper or pasteboard is seldom employed for finished pictures, as their surfaces are not well adapted for the purpose; but they are very much used for making studies from nature, being convenient, from their lightness, for carrying about; they should be prepared either with a coat of size or of thin oil-colour. Sketches or studies made on these substances, in order to preserve them properly, may be afterwards glued to a board or pannel.

Sect. IX. *Transparent Painting.*

Transparent oil-painting, though certainly not entitled to rank with the arts of design, yet being a branch of ornamental painting, sometimes used in scenic decorations, window-blinds, and other similar purposes, we cannot refuse a very few lines to the subject. It is usually executed on fine linen or calico, prepared with several successive coats of fine size (where a fine delicate colour is required) obtained from parchment; or, where the same delicacy is not necessary, a size obtained from weak glue will do equally well. The cloth must, of course, be strained on a frame, and set up against the window while the work is going on. The colours made use of consist of only those that are transparent, and they are ground in lintseed oil like what are used for oil-painting. The outline, or design, being made out with a black-lead pencil, the colours are put on with a quill-brush, and diluted with a mixture of drying oil and mastic varnish, where they are required to be light. In those parts of the work where great depth is required, those pigments which are less transparent, such as umber, burnt ochre, and the like, may be used with advantage.

Sect. X. *Enamel Painting.*

This branch of the art is executed on plates of copper, covered with a ground of porcelain. The colours used are mostly metallic oxides, which, being applied to the plate, receive their colour by exposure to a high temperature in a furnace, in the same manner as the staining of glass and the ornamenting of china-ware. This art has been brought to great perfection in our own time by Mr Bone and others in London, who have executed many fine works in enamel after the pictures of the great masters.

Enamelling, though long applied to the ornamenting of trinkets, has never been much applied to pictures. The processes and materials employed are kept a profound secret. It is a work of much difficulty, and requires much experience and observation to manage the heat and determine the length of time to which the colouring-matters are to be exposed to its action, as the intensity of the colours is not only greatly modified by it, but may be altogether changed or obliterated.

Sect. XI. *Painting in Crayons.*

This mode of painting, which, we believe, was first practised in France by the portrait-painters of the time of Louis XIV. is performed with coloured chalks, rubbed on the paper dry, and without any vehicle.

The crayons consist of the various pigments made use of in oil-painting, ground up with water, and mixed with plaster-of-Paris or stucco, which has been previously set; of fragments of old plaster casts; or scrapings from the figure-makers, which are again ground down to the state of a fine paste on a marble slab, and the colours are mixed with them, according to the strength or lightness of the tint required; the addition of a little pipe-clay will render the crayon smoother and more pleasant to work with. From what we have elsewhere mentioned of the tendency of white-lead to become black, the white used for crayon-painting must consist of zinc white, or any other pigment not liable to change. When the various tints are mixed up, they are spread upon a plate of stucco, in order to deprive them of a portion of the water which is necessary to grind them with, and thus bring them to the state of a thick putty; they are then rolled up into the form of crayons, and when dry they are fit for use. To those who have already acquired some knowledge of the mixing of colours in oil, or water-colour painting, it will be unnecessary to give any precepts for forming the tints for crayons, as they are produced by the same combination. Thus the various shades of yellow are obtained by the mixture in various proportions of ochre, raw terra di Sienna, Dutch, Naples, or other yellow, which again becomes lighter or more intense according to the proportions of white which may be added to them; and, in like manner, the shades of orange, red, crimson, purple, grey, blue, or green, in all their modifications and intermixtures, are produced.

For slighter works in crayons, a tinted paper is often used, the colour of which is occasionally left for the back-ground; but when the work is intended to be highly finished, the paper, previously strained on a frame, and covered with a ground of very fine pumice-dust, is better. For this purpose, the paper ought to have a piece of linen under it, properly fixed on the straining frame, and on this it ought to be pasted. The pumice-stone ought to be finely pounded and carefully sifted, and the paper being laid over with a coat of weak glue and paste mixed together, the powder is dusted over it, and when dry is ready to receive the design, and has the appearance of a fine sand-paper.

Although crayon-pictures have a very agreeable appearance when new, they are infinitely inferior to paintings in oil in point of depth and brilliancy; and besides being liable to fade by exposure to light, as well as to be irretrievably ruined by damp, dust, and every accident, it is not to be recommended for works when durability is required.

Chap. III. Principles of Art proper to Sculpture.

Sculpture is the art of imitating the appearances of objects according to their geometrical figure and proportion, whether by cutting them in stone or wood, casting them in bronze or other metal, or modelling them in clay, wax, and the like.

As the history of sculpture is inseparable from that of painting, we have already treated of both arts in conjunction; we shall now proceed to give a short view of the principles and various processes of this art. And as Invention, Composition, and Expression, and Drawing or Design, are subject to the same laws both in painting and sculpture, we refer the reader to Sections I. and II., of Part II. Chapter I. where they have been already discussed; and we shall now direct his attention to those principles which are exclusively proper to the art of sculpture.

Sculpture, on whatever material it may be executed, comprehends two great classes: *First*, Statues or full figures, and busts, which are either placed in niches in the wall, on the tops of buildings, or insulated, standing on pedestals, in public places, gardens, and the like, as well as in the interior decorations of halls and public and private edifices; and, *2dly*, Works in relievo, wherein the figures are not detached behind from the block on which they are cut. These consist of two kinds, *alto* and *basso relievo*. In the former the figures, though still attached to the wall or block, have their heads, arms, legs, &c. sometimes completely detached, and in other examples, though they may have a bold projection from the plane of the block, they are entirely attached to it. Basso relievo is on the other hand extremely flat and little

Of Sculpture raised from the surface. To this enumeration we may add gems, executed both in high and low relief, in *cameo* and *intaglio*, terms which shall be presently explained.

Sculpture works on relievo were extensively employed by the ancients, and were disposed in pannels on the walls, or formed the decorations of the tympanum, metopes, and whole friezes of their public edifices, and formed always an integral part of the wall to which they were attached.

The province of sculpture is to represent the true form of objects in all their variety of figure, character, and expression; in the execution of which, she demands the utmost purity of design and conception, and a rigid severity and simplicity of style.

Sir Joshua Reynolds in his lectures has given a dissertation on the great end and principles of sculpture, equally admirable for the soundness of his views and the singular felicity of expression with which he has developed them. "Sculpture," says he, "is an art of much more simplicity and uniformity than painting; it cannot, with propriety and the best effect, be applied to many objects. The object of its pursuit may be comprised in two words, form and character; those qualities are presented to us but in one manner or in one style only; whereas the powers of painting, as they are more various and extensive, so they are exhibited in as great a variety of manners. The Roman, Lombard, Florentine, Venetian, and Flemish schools, all pursue the same end by different means; but sculpture having but one style, can only to one style of painting have any relation, and to this (which is indeed the highest and the most dignified that painting can boast) it has a relation so close, that it may be said to be almost the same art operating upon different materials. The sculptors of the last age, from not attending sufficiently to this discrimination of the different styles of painting have been led into many errors. Though they well knew that they were allowed to imitate or take ideas for the improvement of their own art from the grand style of painting, they were not aware that it was not permitted to borrow in the same manner from the ornamental; when they endeavour to copy the picturesque effects, contrasts, or petty excellencies of whatever kind, which not improperly find a place in the inferior branches of painting, they doubtless imagine themselves improving and extending the boundaries of their art by this imitation; but they are in reality violating its essential character, by giving a different direction to its operations, and proposing to themselves either what is unattainable, or at best a meaner object of pursuit. The grave and austere character of sculpture requires the utmost degree of formality in composition; picturesque contrasts have here no place; every thing is carefully weighed and measured, one side making almost an exact equipoise to the other; a child is not a proper balance to a full grown figure, nor is a figure sitting or stooping a companion to an upright figure. The excellence of every art must consist in the complete accomplishment of its purpose; and if, by a false imitation of nature, or a mean ambition of producing a picturesque effect or illusion of any kind, all the grander ideas which this art endeavours to excite be destroyed or degraded, we may boldly oppose ourselves to such an innovation. If the producing of a deception is the summit of this art, let us at once give to statues the addition of colour, which will contribute more towards accomplishing this end, than all those artifices which have been introduced and professedly defended, on no other principle but that of rendering the work more natural. But as colour is universally rejected, every practice liable to the same objection must fall with it. If the business of sculpture were to administer pleasure to ignorance, or a mere entertainment to the senses, the Venus of Medicis might certainly receive much improvement by the co our; but the character of sculpture makes it her duty to afford delight of a different, and perhaps of a higher kind, the delight resulting from the contemplation of perfect beauty; and this, which is in truth an intellectual pleasure, is in many respects incompatible with what is merely addressed to the senses, such as that with which ignorance and levity contemplate elegance of form.

"The sculptor's art is limited in comparison of others, but it has its variety and intricacy within its proper bounds. Its essence is correctness, and when to correct and perfect form is added the ornament of grace, dignity of character, and appropriate expression, this art may be said to have accomplished its purpose. What grace is, or how it is to be acquired or conceived, are in speculation difficult questions. I shall only observe that its natural foundation is correctness of design; and though grace may be sometimes united with incorrectness, it cannot proceed from it. It has been said, that the grace of the Apollo depends on a certain degree of incorrectness; I know that Coreggio and Parmeggiano are often produced as authorities to support this opinion, but the incorrectness of some parts which we find in their works does not contribute to grace, but rather tends to destroy it. Though painting and sculpture are like many other arts governed by the same general principles, yet in the detail, or what may be called the bye-laws of each art, there seems to be no longer any connection between them. The different materials upon which those two arts exert their powers, must infallibly create a proportional difference in their practice. There are many petty excellencies which the painter attains with ease, but which are impracticable in sculpture, and which, even if it could accomplish them, would add nothing to the true value and dignity of the work. Of the ineffectual attempts which the modern sculptors have made by way of improvement, these seem to be the principal:—the practice of detaching drapery from the figure, in order to give appearance of flying in the air,—of making different plans on the same relievos,—of attempting to represent the effects of perspective;—to these may be added the ill effect of figures clothed in a modern dress.

"The folly of attempting to make stone sport and flutter in the air, is so apparent that it carries with it its own reprehension; and yet to accomplish this seemed to be the great ambition of many modern sculptors, particularly Bernini, who, instead of pursuing the study of that ideal beauty which he had so successfully begun, turned his mind to an injudicious quest of novelty, attempted what was not within the province of art, and endeavoured to overcome the hardness and obstinacy of the materials, which, even supposing he had accomplished so far as to make this species of drapery appear natural, the ill effect and confusion occasioned by its being detached from the figure to which it belongs, ought to have been at once a sufficient reason to have deterred him from the practice. It is a general rule, equally true in both arts, that the form and attitude of the figure should be seen clearly and without any ambiguity at the first glance of the eye. This the painter can easily do by colour, by losing parts in the ground, or keeping them so obscure as to prevent them from interfering with the more principal objects. The sculptor has no other means of preventing this confusion than by attaching the drapery for the greater part close to the figure, the folds of which following the order of the limbs, whenever the drapery is seen the eye is led to trace the form and attitude of the figure at the same time. In basso-relievos this is totally different; in those detached pieces of drapery the sculptor has here as much power as the painter, by uniting and losing it in the ground. But here, again, the sculptor, not content with this successful imitation, if it may be so called, proceeds to represent figures or groupes of figures on different planes, that is, some on the foreground and some at a greater distance, in the manner of painters in historical compositions. To do this he has no other means than by making the distant figures of less dimensions, and relieving them in a less scale, but equally near the eye with those in a less degree from the surface; but this is not adequate to the end; they will still appear only as figures on the front of the piece, and by this division of the work into many minute parts the grandeur of its general effect is inevitably destroyed. Perhaps the only circumstance in which the moderns have excelled the ancient sculptors, is the management of a single groupe in basso-relievo, the art of gradually raising the groupe from the flat surface, till it imperceptibly emerges into alto-relievo. Different planes or degrees of relief in the same groupe have a good effect, tho' the contrary happens when the groupes are separated and are at a distance from each other. The next imaginary improvement of the moderns is representing the effects of perspective in basso-relievo. Of this little need be said; all must recollect how ineffectual has been the attempt of modern sculptors to turn the buildings which they have introduced as seen from their angle, with a view to make them appear to recede from the eye in perspective. The ancients, with great judgment, represented only the elevation of whatever architecture they introduced into their bas-reliefs, which is composed of little more than horizontal or perpendicular lines. We come now to the last consideration,—in what manner statues ought to be dressed which are made in honour of men either now living or lately departed; on it I shall only observe, that he who wishes not to obstruct the artist, and prevent his exhibiting his abilities to their greatest advantage, will certainly not desire a modern dress.

Chap. IV. The Practice of Sculpture.

Cutting in marble.—The subject intended to be executed ought to be first drawn on paper; and the artist having satisfied himself of the correctness of the general proportions, and the disposition of the whole, a model is to be made of clay, on a small scale, by which the effect of the whole, both as to the direction of the lines and the appearance it will have when accompanied by the light and shadow, will be seen; and when he has got all this to his mind, he may proceed with the work on the scale proposed.

In works, however, where great accuracy and correctness of form are required, a model of clay should be made, with every detail and circumstance, carefully and correctly; and from this the proposed figure is to be cut, accurately measuring with the compass all the parts. The clay-model, when of a large size, should be built on a frame-work of iron, to prevent it from losing its form by the pressure of its own weight, and, when finished, it ought to be cast in plaster, by which the form will be secured. The tools used in clay-modelling are commonly of wood, bone, or ivory, and are round, pointed, square, or diagonal. But the fingers and thumb are often used alone for blocking out the broader parts. When a model is required to be minutely and neatly finished, its surface is more successfully worked up, and receives more delicacy and smoothness, by using a sort of scraper, formed by a piece of thin wire about four inches long, bending it double, and inserting both ends into a wooden handle; at the lower end the doubling of the wire is kept open in an elliptical form; and it is more or less obtuse according to the sort of work for which it is intended. This instrument is very useful for cleaning or scraping off minute layers of the clay as required.

In copying the model, all the principal projections and hollows are marked upon it, and the block of marble on which the work is to be cut is also marked in the same manner with the utmost accuracy, in order to point out their heights and relative distances from each other. It may be also done in the following manner: the block of marble being set up on a stone basement, or a strong wooden-bench, on the front of which is a narrow slip of marble, accurately divided into feet and inches, another of the same sort is placed before the model; and a wooden perpendicular rule, the height of the whole work, capable of being easily moved about from the model to the block, is applied to determine the exact places of the several points, projections, and hollows. This instrument being placed on the scale of the model, and the exact distance being taken from its perpendicular, say to the point of the nose, and the perpendicular rule being transferred to that scale on which the marble is placed, the workman cuts away the marble from the perpendicular rule at the same height, till he has penetrated nearly to the same depth as the point of the nose in the model from the rule. In this manner all the other leading points are formed. He then proceeds to cut away, with a broad chissel, the surfaces of the marble from one point to another. When hollows are so deep and so intricate that they cannot be cut with small chissels struck by the hammer, drills of different kinds are used to produce them in a rough manner; they are afterwards finished with the hammer and chissel, or by long tools with wooden handles, applied by the hand only, without the hammer. The last finishing of marble, according to the modern practice of sculpture, is performed with rasps and files, bent into proper form, according to the use for which they are intended. The chissels used by sculptors are of steel, of different lengths and sizes; some are the breadth of an inch at the end, others terminate almost in a point. The square and compass are also indispensably necessary for measuring the size and proportions of the different parts. Chissels were, till about the time of the emperor Adrian, the only tools used in sculpture, when the rasp and file seem to have been introduced, or at least came more generally into use; and accordingly all the finer statues of antiquity have been wrought solely with the chissel, or perhaps afterwards smoothed up by rubbing occasionally with pumice-stone or wet grit-stone.

Porphyry was sometimes used for sculpture during the luxurious ages of the Roman empire; and, from the excessive hardness of this material, it must have been a work of infinite labour, as the following circumstance will sufficiently shew: Winckelmann mentions an ancient vase of porphyry at the villa Albani, richly sculptured, which the cardinal Albani wished to have hollowed out; it did not exceed the depth of 13 or 14 inches, and eight or nine in diameter; a workman was employed to perform this, which he completed in ten months, labouring at it constantly for three hours every day.

The tools for working in porphyry are tempered to the hardness of a razor, and seldom bear more than four or five blows before the point is broken. When the tools have done all they are capable of, the surface is ground down with gritstone and emery, a process requiring an immense length of time to complete.

The huge works of the Egyptians, the obelisks, statues, and the sculpture-work in their temples, must have been all executed in a similar manner; and, considering their magnitude and number, it is inconceivable where the workmen and funds were found to execute them.

In working from a model, or in copying another statue, a machine was adopted by the Italian sculptors, which is admirably calculated to insure correctness in distributing the various parts of the figure according to their just proportions and relative distances and bearings with one another. A circular board, called the horizon, is placed on the head of the model, in a horizontal direction, and fixed firmly, so as to prevent all shifting from its original position. It is divided in its whole circumference, like the dial of a clock, into any number of equal parts, and in its centre is fixed a style or hand, like that of a clock, and capable of being moved round in the same manner; this style or hand is marked out into inches, &c. and a plummet and line are attached to it, the line being of sufficient length to reach from top to bottom of the figure. The horizon, marked with degrees, indicates, with the assistance of the plumb-line attached to the style, how far any given figure projects from the centre, and how many degrees to right or left of any given point it may stand, and its height is found by merely applying the foot-rule to the part indicated by the plumb-line; the marble block of course must have an apparatus of the same sort, and divided in every respect in the same manner.

Casts, whether from statues or relievos, of any size, are made in stucco or plaster of Paris, and, when executed by an expert workman, convey, except in point of colour and texture, an accurate and perfect representation of the original. This art has been of the utmost importance to the fine arts, and has been to sculpture, what engraving has been to painting. By means of casts we are become acquainted with the fine remains of antique sculpture, the originals of which it is the lot of few ever to behold; and as, for purposes of study, they are of equal utility with the original marbles, the academies and artists of Europe have always furnished their halls and apartments with collections of them.

The making of plaster casts is founded upon the very singular property of alabaster, gypsum, or sulphate of lime, treated in a particular manner, and reduced to a fine powder, by which, when mixed with water, to the consistency of a thin paste, it becomes hard, and retains permanently the form of the vessel or mould into which it is poured. In casting basso-relievos, and such figures as are only half-round, or have no *under-cutting*, (or what is called by the Italians, *sotto squadro*,) the process is conducted by simply pouring the wet plaster on the mould, previously rubbed over with a little oil of turpentine with a brush, and when it has stood for a few minutes it may be taken out, and is finished. In figures that are to be cast all round, or even any thing more than half-round, the mould consists of several pieces, which admit of being separated to let out the cast, when the plaster has set. In very large figures, the extremities, head, &c. are, for the greater facility of casting, moulded in separate pieces, and afterwards cemented carefully together with wet plaster; the seams or marks formed over the surface by the joinings of the mould are then carefully scraped off with an iron instrument, and polished down with rushes. The moulds are made of plaster, and saturated with boiled linseed oil, which gives them great hardness and durability; but for small cameos, medals, and the like, they are sometimes made of sulphur, which gives a very sharp impression. In making the mould of a large figure, the number and size of the pieces which compose it, are regulated by the elevations and depressions, so that they may be easily disengaged from one another. The figure to be moulded is placed in a horizontal position, and oiled where required in order to prevent adhesion of the plaster. The plaster, mixed with water to a proper consistency, is then poured over the part judged most proper to begin with; when this is become hard it is taken off carefully, squared round the edges, and at the same time a number of small hemispherical cavities about the size of a pea are cut in them; the edges are then saturated with lintseed oil, and the piece replaced on the figure whence it came: The plaster is now applied to one side of this first piece, and is allowed to harden; it is then taken off, and will be found to fit exactly with the piece next it, and to have received the impression of the hemispheres hollowed out on it, which will of course on this be convex. These projections and cavities are of the greatest importance in adjusting the several parts of the mould to each other, closing them up correctly, and preserving them in their places without shifting. In this manner the whole mould is formed, piece by piece, and when completed is well saturated with oil, and set aside to harden.

Moulds that have been formed upon the original marble are obviously the best; for when they are taken from another cast they cannot be so perfect in the more minute parts.

Moulds may be also formed from clay models, and should be done before the clay becomes dry and loses its form by shrinking.

Wax-Modelling.—This mode of sculpture is of great importance, from the delicacy of which it is susceptible, and from its extensive application in the arts, wax being the material on which models for small works in bronze, for medals and coins, and the patterns of all ornamental work of the goldsmith and chaser, are executed. It has been also much employed lately for small cameo portraits, and for works of much less classical character, viz. portraits of the size of life, the faces and hands of which are executed in wax, coloured, to represent the tints of nature, while the hair and clothing are respectively the works of the perruquier, and the taylor, or mantua-maker. This latter barbarous mode of sculpture has been very much practised in modern times, and has even found an asylum within the consecrated walls of Westminster abbey, under the patronage of the dean and chapter, who have already formed a very singular collection of specimens of this mode of art, to which they still from time to time continue to make additions. This *unique* collection, so disgraceful to the public taste, so derogatory to and inconsistent with the dignity of the edifice, forms one of the grand objects of the ignorant admiration of visitors, the tattered finery of the figures having excited the wonder and astonishment of the most numerous class of his Majesty's subjects, forms a very fertile source of revenue to that incorporation.

Coloured wax, however, has successfully been applied to a purpose of greater utility, and of a more legitimate character, in forming imitations of the morbid appearances of animal bodies, coloured, to represent the natural tints of the object. This application of the art has been of the greatest advantage in the study of anatomy, from the fidelity with which it may be made to sustain the form and colour of those objects which rarely occur, or are difficult to prepare. Accordingly, for the purposes of medical instruction, museums have been at various places formed, as at the university of Dublin, which possesses models of those morbid changes in different stages, wherein, in point of form and colour, there is any remarkable deviation from the usual appearances of nature in her sound state. When the subject is on a small scale, it may be made entirely with wax; but when of a large size it may be cast in plaster of Paris, and coated over with wax, melted on the fire, and diluted to a proper consistency with oil of turpentine, and laid over the model with a painter's brush, and then coloured.

Modelling wax is formed as follows; Two cakes of virgin wax, broken into small pieces, are put into a clean earthen pot; to this is added a small quantity of Venice turpentine, the size of a hazel nut, and about double the quantity of flake-white, very finely pounded; the pot is put upon a slow fire, and when the wax is melted it is stirred round in order to mix the ingredients; when this is sufficiently done, it may be poured out to cool, and is ready for use. When the wax is required to be of different colours, they are produced by substituting for the flake-white the colour required; and in order to reduce them to a very fine powder, they ought to be previously ground with oil of turpentine.

The modelling of wax is performed with the same instruments as the clay, viz. tools of wood and ivory, of different forms.

Sculpture in bronze.—This, like the other modes of the art, is executed from a model, and may be performed by casting from a mould taken from the model, carved from a block of the solid metal, or chased on a flat piece of metal.

The mould in which bronze figures are cast, is formed of stucco or plaster of Paris, in the same manner as the moulds for plaster work, and when wet, the seams on the cast, arising from the joinings of the mould, are filed off, and any sharp touches, or other improvements that may be required are given with the chasing tools; for cheaper works, lead is sometimes used instead of bronze. In chasing, the flat plates of metal are beaten out and hollowed in the inside, to give the necessary relief; and when the general figure has been produced in this way, the several parts, with all their details, are given with the tools. The instruments used in chasing are, a small hammer, with a long elastic handle, which gives the blow with a smart and artificial force, and chissels and points like those used in the sculpture of marble.

Carving in wood.—Sculpture or carving in wood, which, from the nature of the material, is easily injured by the inclemency of the weather, is chiefly employed in the internal decorations of our houses and furniture, but has, in the revolutions of fashion, been superseded in a great measure by plaster, and what is called composition, or putty.

Wood-carving is performed with sharp chissels, gouges, and such instruments, inserted into wooden handles, which are applied either with the simple power of the hand, or, as it may be required, by the blows of a wooden mallet; and these different instruments, according to the purpose for which they are required, are either straight or crooked, flat, convex, or concave.

When the work to be done is on a large scale, it is executed on a block, consisting of several pieces of a convenient size, firmly cemented with glue. When working in relief, particularly on a small scale, the wood should be fixed in a temporary manner by means of glue, and thus kept steady on the bench or work-table: after the work has received its last touches from the tools, it may be smoothed all over with sand-paper.

Casting in composition or putty.—Ornaments in composition, at present much in use for chimney-pieces and picture frames, are generally cast from moulds cut in wood in reverse or intaglio, and sometimes from brass cast and chased: as a measure of economy, the moulds themselves are sometimes cast in composition, and sometimes in sulphur; but neither of these is so convenient, the former material being liable to shrink, in drying, particularly when on a large scale, and the latter, being brittle, is easily injured.

This substance called composition consists of a mixture of fine whitning or chalk mixed with strong glue, to which some add a greater or less proportion of Burgundy pitch; it should be put into the mould while warm, and pressed into it with a screw-press, and allowed to remain till it become cool. In order to prevent the putty from adhering to the mould and spoiling the impression, it should be previously well rubbed with oil of turpentine.

Engraving precious stones or gems.---This art was very extensively practised by the ancients, in which, as in other branches of sculpture, they arrived at very great excellence. The specimens of this mode of ancient art that have been preserved are exceedingly numerous, and, as well as coins and medals, are occasionally discovered or dug out of the earth, in Greece, Asia Minor, and those places where the Greeks had founded colonies; and from the smallness of their size, and the hardness and durability of the material, being little liable to injury, are commonly found quite entire. These gems are either cut in relief, and are called *cameos*, or in reverse, for giving impressions to wax, &c.; these are called *Intaglios* by the Italians, and by the French are said to be *en creux*.

The engraving of gems is the most laborious and arduous of all the departments of sculpture; for, besides the requisites of scientific drawing and composition, common to painting and sculpture, which are equally essential to this department of art, the gem engraver has great difficulties to encounter, arising from the hardness of the materials on which he executes his work, the smallness of the scale, and the peculiar nature of his tools, by all which considerations the style of his compositions must be regulated and modified.

The ancient gem-engravers were not intimidated by the difficulties of cutting the hardest stones, sapphire, ruby, onyx, beryl, and even diamond, as well as hyacinth, topaz, chrysolite, amethyst, and carnelian; in the best specimens of all which, we know not whether to admire most the wonderful patience and industry which executed them, or the genius and taste by which the workmanship was directed.

In cutting the onyx, calcedony, and those stones which consisted of layers or zones of different colours, the ancient artists applied them to represent the various colours of the substances; thus we find some gems of heads consisting of one colour for the face, another for the hair, and a third for the back ground; sometimes pieces of drapery, head-dress, and the like, were introduced in the same manner, and were no doubt suggested by the colour of the stone, as the work went on. This practice has also been imitated in modern times, and Laurent Natter, in his "Traité de la Methode Antique de Graver en Pierres Fines," describes a gem he had cut for Christian the Sixth of Denmark, for one of the royal orders, in this manner: The stone was oriental jasper of different colours; on it he executed, in relief, an elephant with a tower on his back. This tower was reddish, the covering of the elephant green, and incrusted with five little bright crosses, (encrustie de cinq petits brilliants en forme de croix); the elephant and figure on his back were white, and the two feet next the background were of the colour of clear shadow, and the whole back ground itself was green with red spots.

The instruments used in gem-engraving are various sorts of pointed, spherical, flat, and circular tools, like buttons or disks, of different thicknesses and diameters, fixed to an axis in their centre; their edges are semicircular, square, or pointed, according to the work for which they are intended. A hollow cylinder is also employed for describing circles, or perforating the stone. These instruments are described and illustrated by a plate in Nutter's work above described. The axis of these tools being fixed to a turning lathe, they are made to revolve on it by working the treddle with the foot; and the stone to be cut being previously fixed to a piece of wood with mastic, in order to be easily held in the hand and moved about as required, is applied to the edge of the instrument as it moves round, and at the same time the powder of diamonds, mixed with olive oil, is applied to the tools, by which the operation is performed with greater ease. These instruments vary from the size of a large pea to that of the point of a needle, and are made either of soft iron or copper, and sometimes boxwood. The point of a diamond is also used.

The art of making mineral pastes, capable of receiving impressions from gems, and coloured in imitation of the natural stones, was also much practised by the ancients, and has been revived with great success in modern times. A quantity of soft, red tripoli, pounded in an iron mortar, and finely sifted through a silk sieve, is mixed with water to the consistency of a paste, and put into a flattish crucible, of little more than the breadth of the gem, to be moulded. Yellow or Venetian tripoli, previously bruised with a glass pestle in a mortar of the same material, till it be reduced to a very fine powder, is strewed over its surface; upon this the stone from which the impression is to be taken is placed, with its face next the powder, and is pressed down so as to give a clear and perfect impression upon it. It is allowed to remain a few minutes till the dry powder have absorbed some part of the moisture from the paste below; it is then carefully disengaged from the tripoli with a needle fixed into a wooden handle, and removed by inverting the crucible. the tripoli still adhering to it. It is now necessary to observe that the impression has been perfectly communicated to the tripoli, otherwise the cast afterwards made would have a defect corresponding with that on the mould. The tripoli is now carefully dried, and the glass paste (the composition of which we shall presently describe) intended to form the gem, is put over the mould, but in such a manner as not to injure the impression on it; they are then placed gradually nearer the furnace, and when heated so as not to be touched with the hand, it is placed in the furnace under a muffle and surrounded with charcoal; when the glass paste begins to become bright, it is ready to receive the impression. It is now taken out of the furnace, and the paste is pressed into the mould with an iron instrument; the crucible is set near the furnace to cool gradually, and anneal the paste; when cold the gem may be taken out, and in order to prevent cracking it is nipped round the edges, and if the gloss on its surface be too great it may be taken off by means of muriatic acid.

Paste impressions of pure transparent glass, in intaglio, are sometimes filled up with some white or coloured pigment, and when viewed from behind have a very singular and beautiful appearance, like a cameo of some extraordinary substance, covered with a plate of glass. Casts from antique gems are often made in plaster of Paris or sulphur, and very interesting collections of them are often formed, and are preserved in the cabinets of the curious.

The art of making mineral paste for imitating gems, has been explained by M. Fontanieu.

It consists of a colourless base, to which are added metallic oxides to produce the tint of the mineral proposed to be imitated. It is obtained from flint and siliceous substances, pebbles, rock crystal, or pure sand. Any of these substances, previously well pounded, is put into a crucible and raised to a red heat in a furnace; the contents are emptied into a wooden basin filled with cold water, washed, and separated from any foreign bodies. The water is then poured off, and the mass being dried and pounded, is sifted through a sieve of the finest silk, after which the powder is digested for four or five hours in muriatic acid, during which process it is frequently shaken. The acid being then poured off, a pure vitrifiable earth remains, which, after being properly washed, is dried and sifted, and is then fit for use. From the earth thus prepared Fontanieu formed six different bases.

1st Base.—Twelve ounces of rock-crystal or flint prepared in this way: twenty ounces of lead in scales, four ounces of nitre, four ounces of borax, two ounces of arsenic well pulverised and mixed, are fused in a Hessian crucible, and poured into cold water three times successively, each time in a new crucible, and the lead that may be revived must be always carefully separated.

2d Base.—Eight ounces of prepared flint, twenty ounces of ceruse, or white lead, four ounces of salt of tartar, and two ounces of calcined borax, are fused in a Hessian crucible, and poured into cold water; this is to be repeated three times, and washed, as in the former case.

3d Base.—Eight ounces of prepared crystal, sixteen ounces of minium, (or red-lead,) four ounces of nitre, and four ounces of salt of tartar, treated as before.

4th Base.—Eight ounces of rock-crystal, twenty-four ounces of calcined borax, eight ounces salt of tartar fused together, and poured into warm water; the mass being dried, an equal quantity of minium is to be added, and the whole fused and washed as before.

5th Base.—Eight ounces of rock-crystal, or pounded flint, are baked along with 24 ounces of salt of tartar, and allowed to cool. The tartar is then poured into a crucible of hot water to dissolve the frit; the solution is received into an earthen pot, and nitric acid added till it ceases to effervesce. The water being decanted, the frit must be washed in warm-water till it have no longer any taste; and being then dried and mixed with twelve ounces of fine ceruse or white lead in scales, the mixture is to be well levigated with distilled water; an ounce of calcined borax is now to be added to twelve ounces of this powder when dried, the whole well mixed in a marble mortar, and then fused and poured into cold water, as formerly directed; it is now finely pulverised, and five drachms of nitre are to be added, and the whole to be melted for the last time, when a mass of crystal is formed of a very beautiful lustre.

This substance was esteemed by M. Fontanieu as the finest of all those compounds, and is known by the name of the Mayence base.

6th Base.—Three ounces of rock crystal, eight ounces of ceruse, two ounces of finely pulverized borax, half a grain of manganese, treated as above, make a very fine white crystal.

The various colours of gems are produced by adding, to the bases above described, metallic oxides, according to the colour required. The oriental topaz is imitated by adding five drachms of antimony to colour twenty-four of the first or third base. The amethyst, by adding to twenty-four ounces of the Mayence base four drachms of manganese, previously exposed to red heat, and quenched in distilled vinegar; it is then dried and pulverised, and passed through a silk sieve along with four grains of precipitate of cassias.

The art of fabricating artificial gems has been brought to great perfection in point of lustre and brilliancy of colour; but they may be easily distinguished from real gems by their inferior specific gravity; and being considerably softer than the true ones, they are easily acted on by a file.

The diamond is imitated by the Mayence base alone, which is very brilliant, and perfectly colourless. But on this part of the subject our limits will not permit us to enlarge; we therefore refer our readers to the work of M. Fontanieu, who has been eminently successful in fabricating those artificial gems, and has also communicated the results of his experience with much candour and liberality; and the accuracy of his information is fully established by the success that has attended those who have adopted his recipes. His work is entitled, "*L' art de faire les Cristaux,*" printed at Paris in 1778. There is also, by the same author, an abstract of it in the "*Journal de Physique*" of that year.

PART III. ENGRAVING.

Engraving is the art of making, by means of incision, corrosion, or otherwise, on copper, wood, &c. those polygraphic imitations of pictures, called prints, which are worked off by means of the rolling or printing-press, and may be multiplied to any extent, according to the depth of the incision, and the durability of the substance on which the work is executed.

The term *engraving* is also applied to that department of sculpture which comprehends the cutting of gems, signets, or seals, and other similar works.

Although this art, in its application to the delivering of impressions upon paper, be entirely a modern invention, it was practised in the earliest ages in the enrichment of gold and silver ornaments, in the decorations of instruments of war, and the vessels used for sacred rites, as well as in making idols for worship, and other similar purposes, having long in point of time preceded the operation of chasing.

The art of engraving has been of the greatest importance to the fine arts, to which it bears the same relation as printing to philosophy and the sciences, being also to them a powerful auxiliary by the facility of illustration which its graphic delineations and diagrams afford to written language; and of all imitative arts, not even excepting painting, it has been most subservient to the purposes of general utility, by the facility of multiplying the impressions, and the ease with which they may be preserved.

By means of this art, those works of the art of painting celebrated for their excellencies, the admiration of the scientific connoisseur, and the theme of applause of the enlightened traveller, which would be known only by report, confined for ever to the palaces or churches in which they are shut up, acquire, by multiplying their engraved copies, a perpetuity of existence, and a sure asylum against the injuries of time and violence, and are widely disseminated over distant countries at a moderate expense. Thus those monuments of genius, the ceilings and mural pictures of Raffaelle, and the sublime beauties of the Capella Sistina, the master-pieces of Michael Angelo, which are gradually disappearing in the lapse of years, and the injuries to which, during so many centuries, they have been exposed,—those works, which would have been known to us only by tradition, and the indeterminate and unintelligible verbal description of contemporary writers, are preserved by means of their engraved copies by Marc Antonio and his school, and by them we may form a clear and distinct idea of all those excellencies that depend on form, their invention, composition, grouping; drawing, grace, and expression. We are further reminded of the importance of this art, by the consideration of what has been for ever lost to us, for want of the illustration which it would have afforded, in clearing up many obscure passages in ancient authors, in the departments of history, monuments, arts, sciences, and philosophy, in all which it would have done more to satisfy our rational curiosity than the disinterment of a thousand cities like Herculaneum and Pompeii.

Sect. I. *Origin of Engraving.*

Without entering into any details on the history of the art of engraving as it existed prior to its application of delivering impressions, which was discovered in the fifteenth century, it will suffice to say, that it was extensively practised by the Egyptians, Hebrews, and other ancient nations, and that the Romans even applied it to the stamping of pottery and packages, which renders it rather surprising that, having gone so far as to form even three lines under each other, they did not discover the art of printing. Several of the stamps with which this process was performed, cut in bronze, have been found in Herculaneum, some of which are preserved in the British Museum, and representations of them are to be found in Strutt's Dictionary. As they are cut in reverse like printing types, that the impression of the letters when stamped might appear the proper way, there can be no doubt of the purpose for which they were intended.

Sect. II. *German School.*

The first engravings were undoubtedly printed from blocks of wood, and although no record exists of the period when this art began to be practised, it is certain that it was invented in Germany, by the makers of playing cards, long before the middle of the fifteenth century, and at a time when the art of copperplate engraving was totally unknown.

The honour of the invention of copperplate engraving is contested chiefly by the Germans and Italians; and from the nature of the evidence adduced there is considerable difficulty in settling the question: On the one hand, Vasari positively asserts that it was discovered by Maso, or Thomaso Finiguerra, a goldsmith of Florence, about the year 1460, who, having engraved some figures on a silver plate which he intended to enamel, in order to try the effect of his work, poured upon the plate some liquid sulphur, and the dirt or black lodged in the crevices adhering to the sulphur produced an impression like a pen drawing, and suggested to him the idea of an impression upon paper, in which he ultimately succeeded. The works of Finiguerra had long remained unknown, though diligently sought after by collectors, and one or two only have been recently discovered. Mr Bryan, in his Dictionary, mentions, that Mr Huber gives a particular description of twenty-four prints in the possession of M. Otto at Leipsic, consisting of fabulous subjects, ascribed to Finiguerra, and certainly amongst the earliest productions of the Italian school which have been judged by M. Heinecken to be original; they had been in the collection of the celebrated Baron de Stosch, who met with them during a long residence at Florence. The evidence in favour of the claims of the Germans is chiefly circumstantial, but certainly entitled to great attention: First, That the first book printed at Rome also containing engravings, (only maps,) the Cosmographia of Ptolemy, was conducted successively by two Germans. The dedication to Pope

Sixtus IV. says that, "Magister Conradus Suyenheym, Germanus, a quo formandorum Romæ librorum ars primum profecta est, mathematicis adhibitis viris, quemadmodum tabulis Æneis imprimrentur edocuit;" and that on his death, " Arnoldus Buckink e Germaniâ—ad perfectum opus succedens—perfecit." This book bears date 1478; but it appears that it had been begun in 1472. It is thus decisive that the new art was brought to Rome by Suyenheym; so that if it was discovered by Finiguerra, it must have been kept a profound secret for eighteen years. Second, However defective in point of design, the early works of the German school display *beauty* of execution, and *delicacy* of finishing, indicating very considerable advancement in the mechanical part of the art, while the works of the contemporary Italians are in a style of rudeness and simplicity, evincing the very first dawnings of the art. A comparison of the works of Sandro Boticelli, Antonio Pollajuoli, and even of Andrea Mantegna, with those of Martin Schoen, and the other German masters of that time, sufficiently confirms the justice of this observation.

Card-playing seems first to have been introduced into Germany about the year 1350, or 1360; and it is probable that shortly afterwards the method of printing the outline of the figures from blocks of wood, and colouring or illuminating them with the hand, was discovered, which practice was long in use before this principle was applied to printing the colours; and so extensively was this species of manufacture carried on, that it, in a short time, became an article of commerce with Italy, Sicily, and other countries. There is still preserved, *vide Lettere Pittoriche*, a memorial addressed to the senate of Venice, by the card-makers of that city, complaining of the injury done to their craft by the competition of foreigners, and praying the senate to grant them an exclusive privilege to make and sell them within their jurisdiction; and that, not only for cards, but for whatever was painted or printed on cloth or paper, such as altar-pieces, that is to say, images of saints. The date of this memorial is 11th October 1441.

From the mode of expression in the answer of the senate which granted this request, it is evident that the cards were stamped or printed first, and afterwards illuminated. The expressions are, " carte e figure stampide che fanno in Venezia;" and in another place, " le carte da Zangar e figure dipinte stampide che fanno fuor' di Venezia."

But the true era of the origin of engraving must be fixed somewhat later, when the popular devotion for the images of saints, which, about the middle of the 15th century, had in Germany arisen to the most extravagant height, suggested the idea of executing figures of this description in the same manner as those on cards. These images were usually of the same size and style of execution; but there were also published many series of Scripture histories, monkish legends, and similar subjects, as well as single figures of a larger size, which also contained mottoes, texts of Scripture, or other matter illustrative of the subject, sometimes of considerable length, and cut on the same block. These were liberally distributed by the clergy in order to excite the devotion of the piou, and for the edification of those who could not read. Several of these works are still extant in the libraries of the curious; the most celebrated are the " Ars Moriendi; Historiæ Veteris et Novi Testamenti," or Poor Man's Bible, a work containing about 50 plates; " Historia seu Providentia Virginis Mariæ, Ex Cantico Canticorum: Historia Beatæ Mariæ Virginis, ex Evangelistis et Patribus excerpta, et per Figuras illustrata,' consisting of five plates, representing different subjects, of angels, saints, devils, and dying persons.

But the most curious of all these works is what is called the Buxheim print, representing St Christopher carrying the infant Jesus over the sea: On one side is a hermit holding a lanthorn to light him, on the other is a peasant with a sack on his back, climbing up a mountain. This relique was discovered in the Chartreuse at Buxheim, near Memmingen, one of the most ancient monasteries in Germany, pasted within the boards of a manuscript of the 14th century. It is in the most wretched style of execution; but it is valuable, as being without doubt the oldest engraving extant, as is ascertained by the date which it bears, 1423. It is now, we believe, in the collection of Earl Spencer. A correct copy of this singular production will be found in Jansen *Origine de la Gravure*, Paris 1808; and copies of others of these works are preserved in Heineken, *Idée Generale d'une Collection complette d' Estampes*. They were printed only on one side of the paper, but in some copies they are pasted in pairs back to back, in order to appear as if printed on both sides.

In these barbarous works, however, both printing and engraving originated; and while the latter was advancing with a regular pace towards that perfection which the talents of Albert Durer conferred on it, the other remained neglected, till the bold and original genius of Guttemburgh of Strasburg, in conjunction with Faust, discovered the method of making moveable metallic types, and produced in the year 1450 their famous edition of the Bible, the first book ever printed.

As the art improved, it exerted itself on more important objects; and in a short time, as the principles of composition and design became better understood, it rose from a handicraft trade to the rank of a liberal art.

After the Buxheim print just mentioned, the earliest collection of wood cuts, with dates, is the Chiromancy of Dr Hartleib; a work dated 1448, supposed by Strutt to have been executed by one Jorg Schapff, from his name appearing on one of the plates. They are in a very rude style, but apparently not of so early a date as the Poor man's Bible. The names of Hans Sporer and Johan von Paderborn next occur in the chronological enumeration of the engravers of this period, but of their works nothing is known. John Schnitzer of Arnsheim engraved, for the edition of Ptolemy printed at Ulm in 1486, the set of geographical charts. But the first book printed in Germany, containing wood cuts worthy to be considered as works of art, was the Nuremberg Chronicle, a compilation of Hermann Schedel, printed in folio, and embellished with prints engraved by Wilhelm Pleydenwerff and Michael Wolgemuth. These plates are cut in a style of great spirit, and consist of figures, landscapes, views of towns; and though abundantly embued with the meagre stiffness and Gothic manner, characteristic of the German school of that period, the heads are often marked with much truth, and exhibit a very considerable improvement in the state of the art. Of the history of Pleydenwerff and Wolgemuth little is known; it was, however, under the latter that Albert Durer received the first rudiments of his education in the arts of painting and engraving.

The early history of copperplate engraving, which, like the other branches of the fine arts, arose gradually from the state of a mechanical trade to the rank of a liberal art, is involved in great obscurity; it was, as in Italy, originally practised by the goldsmiths, who had acquired considerable dexterity in the management of the graver in the course of their ordinary employment in cutting cyphers, coats of arms, and other devices on their gold and silver plate. The first copperplate engravings executed in Germany are, accordingly, the productions of the goldsmiths; and as they seem to have attached little importance to their works, they are only distinguished from each other by monograms, cyphers, or initial letters, and their names are totally unknown.

The first artist whose name has been preserved is Martin Schoen, a painter, engraver, and goldsmith, born at Culmbach in Franconia about the year 1420, but he resided chiefly at Colmar, where he died in 1486; he is called by some of the German writers Hupsche Martin, by the Italians Buon' Martino, and by Vasari, erroneously, Martin of Antwerp. Although his drawing of the human figure be incorrect, and his composition dry and formal, his heads have often a fine expression. Notwithstanding the defects in the drawing of his figures, with which he and all his contemporaries are chargeable, the other parts are delineated with much truth and precision; of this his plate of the chalice or censer bears powerful testimony, being an object of very complicated parts, drawn with infinite vigour and correctness, conceived along with its appendages with great taste, and executed in a style of astonishing firmness and precision. Martin Schoen is supposed by some to have been a disciple of Stoss or Stolzhirs, an engraver said to have flourished as early as 1460; but this is a fact by no means well authenticated. It does not appear that Martin Schoen ever engraved on wood. He possessed a fertile and vigorous imagination, and a genius which, had he lived in a more enlightened age, would have placed his name amongst the brightest ornaments of the art. His plates are executed with much mechanical skill and delicacy; the number of his works is very great, and they are principally from his own composition.

Israhel van Mecheln or Mekenen, also a goldsmith, was a contemporary of Martin Schoen, born at Mecheln, near Bocholt, in the bishoprick of Munster, in Westphalia, about the year 1424. As some of his plates are dated as early as 1460, or according to some 1450, and as late as 1505, as well as from the difference in the style, it has been conjectured by M. Heinecken, and with much probability, that there had been two persons of this name, father and son. The disciples or imitators of Martin Schoen were numerous; amongst them may be reckoned his

 brother, Bartholomew Schoen, Albert Glockenton, the elder Schæuflin, Francis van Bocholt, Jerome Bosche, Wenceslaus of Olmutz, Adam Gamberlin, Mathew Zagel, and Mair, with many others whose names have not been preserved.

The German masters not having the advantage of improving their taste by the study of the antique, which their contemporaries in Italy enjoyed, exhibit none of the purity and elegance of design which the Romans and Florentines had at this time acquired in so eminent a degree. But, as far as relates to mechanical execution, the art was brought to the greatest perfection by Albert Durer, who, by introducing the study of anatomy and perspective, gave more sound views of its genuine principles. Albert Durer was born at Nuremberg in the year 1471, and became a disciple of Michael Wolgemuth, from whom he learned the arts of painting and engraving; he was the first of this school who improved the style of representing the human figure. He possessed wonderful command over the graver, and some of his plates exhibit examples of excellence which, notwithstanding the lapse of so many centuries, have hardly been surpassed to this day. His wood cuts are executed with all the spirit and force of pen and ink drawing, and are, of all the works of the German masters in this department, by far the most esteemed. The earliest dates in his plates are 1497; he died at Nuremberg in the year 1528.

About the year 1499, Mair, supposed to have been a disciple of Martin Schoen, invented chiar' oscuro engraving; which consisted in making out the outline and deep shadows on the copper, and producing the effect of the middle tint by means of a wooden block, from which the parts intended to be left entirely white were cut out. This invention is also ascribed by the Italians to Ugo da Carpi, a painter and engraver, born at Rome in the year 1486; but on comparing the date of Mair's print with that of the birth of Ugo, it at least cannot be supposed that Mair was indebted to him for the invention; besides, the method of Da Carpi differs from those of Mair, as his prints were executed with three separate blocks of wood, without making use of the copperplate outline at all. Chiar' oscuro engraving was also practised by Albert Durer, Lucas Cranach, and also by an engraver called by some Johan Ulric, and by the abbe Marolles and other French writers, from the cypher he made use of, *le maître aux bourdons croisees;* but as the plates of this latter artist have no dates, there is considerable difference of opinion about the period at which he flourished. Heinecken places it before the end of the fifteenth century, while others, judging from the style of his composition and drawing, suppose him to have lived in the middle of the next century, and even to have studied the Italian masters. Lucas Cranach, whom we have just mentioned, also executed several engravings on copper; he was born A. D. 1472; was chiefly employed by the elector of Saxony, and died at Weimar in the year 1553; he is rather distinguished for the fertility of his imagination, than for the goodness of his taste or soundness of his judgment, and having contributed little to the advancement of the art he does not merit much attention. In recording the names of the engravers of this period, we cannot pass over that of Hans Holbein, born in the year 1498, whether at Basle or Augsburg it is uncertain. His fame chiefly rests on his paintings of history and portraits, but he also merits particular attention in this place from the great number of wood cuts which he executed in the early part of his life. The most remarkable of these are, *The Dance of Death*, consisting of fifty-three plates executed from his own designs, and a series of ninety small cuts, being subjects taken from the New Testament, executed with much spirit as well as delicacy; he also engraved many vignettes, frontispieces, and ornaments for goldsmiths. He died of the plague at London in 1554.

Among the disciples or imitators of Albert Durer, the most conspicuous are, Henry Aldegrever, Burgkmair, Albert Altdorfer, the younger Schaeuflin, Gregory Pentz, and James Binck; these we shall presently consider at greater length. At this time also Lucas van Leyden, usually considered the patriarch of the Dutch school, and the intimate friend of Albert Durer, practised the art at Haerlem with great success. His style differs considerably from that of Albert, and seems to have been derived from Israhel van Mecheln; his figures are meagre, and his attitudes are generally ungraceful; his execution, however, is neat and clear; but there is often a want of breadth in his effect, from the masses not being sufficiently connected; and his stroke being equally fine in the foregrounds as well as distances, his plates are destitute of that boldness and strength which would be desirable.

The chief of these disciples of Albert Durer is certainly Henry Aldegrever; he was born at Zoust in Westphalia in 1502, and was sent to Nuremburg in order to study under Albert Durer, whose style he imitated, but to it he also added some portion of the elegance of the Italian school, which began to be known in Germany by the Italian prints which were introduced into the country at this time. He is among the first who improved the method of representing flesh by the use of dotted lines, which has subsequently been improved upon and carried to such perfection by the French engravers; his drawing of the naked is much more correct than that of his predecessors, his heads have much expression, and the extremities are well marked.

Gregory Peins or Pentz was first a pupil of Albert Durer, but, going to Italy, he wrought under Marc Antonio, where his taste was improved, and where he acquired that excellence in design for which he is so much distinguished; his plates are executed entirely with the graver, which he managed with great skill, freedom, and precision; and it is thought that some of Marc Antonio's have been brought to a state of considerable forwardness by him. Although he is usually classed with the little masters, he executed several large plates after Giuglio Romano and other masters of the Italian school.

James Binck was born at Nuremberg, or, according to some, at Cologne A. D. 1504. He first studied under Albert Durer or Aldegrever, and improved himself under Marc Antonio; he died at Rome in 1560.

Hans Burgkmair was born at Augsburg in 1474; he was both a painter and engraver, and imitated Albert Durer, his preceptor and friend. His prints are principally wood cuts, and are executed with much fire and spirit. His prints are numerous. A great part of the cuts of "*The Triumphal Entry of Maximilian*," consisting of 133 blocks, though generally attributed to Albert Durer, is ascertained to have been his work. The blocks themselves, which had remained for a long period unknown at the castle of Ambras, have been recently removed to the imperial library at Vienna; since which time impressions have been taken from them, and many sets have been brought to England, and a copy of the work is in the Advocates' Library at Edinburgh.

Virgilius Solis was born at Nuremberg in 1514; it is not known under what master he studied; his early works bear a considerable resemblance to those of Sebald Beham. Although it does not appear that he ever studied in Italy, he executed many plates after the designs of Raffaelle and other Italian masters, in which he adopted a more open and spirited style.

About this time also flourished Hans Sebald Beham, and his brother Bartholomew, and Virgilius Solis.

The first of these artists was born at Nuremberg in 1500; his drawing of the figure though somewhat gothic and stiff is in general correct, the airs of his heads are expressive, and not altogether destitute of elegance. He was a man of considerable genius and of a fertile imagination; he engraved both on wood and copper, and his works are much esteemed; his copperplates are executed entirely with the graver, and are possessed of great neatness and delicacy, and his wood cuts are executed with great freedom and spirit. There are also a few etchings attributed to him, but whether they are in reality his work is uncertain.

Bartholomew Beham was the brother of Hans, and was born A. D. 1496; he was a painter, but is principally known as an engraver; he studied in Italy, and probably in the school of Marc Antonio, whose style he imitated with the greatest success; his drawing is masterly and correct, and the expression of his heads is very fine.

Virgilius Solis was born at Nuremberg in 1514; his early plates are executed in the style of Sebald Beham; but when he engraved from the Italian masters, he adopted a style of more openness and spirit. He engraved both on wood and copper, but the former are most esteemed; his works amount to upwards of eight hundred prints.

The greater part of the engravers of this time having executed their plates on a small scale, have acquired the name of "*The little masters*." Among the other artists of the German school who flourished about this time, we may mention Henry Lautensack and his son Hans Sebald, Brosamer; David Jerome and Lambert Hofper, and Melchior Lorich; but as these engravers and their successors, for almost half a century, added nothing to the boundaries of the art, we cannot find room to enter more into detail on the subject.

In a short time the beauties of mechanical execution, which marks in so distinguished a manner the style of Albert Durer and the little masters, his immediate successors, became much neglected; so that before the middle of the sixteenth century till the time of H. Goltzius, Muller, and Lucas Killian, notwithstanding the immense number of engravings that the German masters produced, and many of them certainly works of considerable merit, the art seems to have been on the decline. The works of Adrian Collaert and his son Hans, Abraham Bruyn, Theodore de Bry the elder, and other engravers, are sufficient exemplifications of this fact. We cannot, however, leave unnoticed the following artists who flourished at this time; and although the gothic manner, characteristic of this school, began at this time to disappear, they adopted little of the grace, purity, and expression of the Italians, which could not be unknown to them.

The works of Cornelius Cort, a native of Hoor in Holland, are, however, a striking exception to this, as he did much to improve the art; but as his best works were executed in Italy, where he ultimately settled and died, he must be considered as belonging rather to the Italian school, amongst the masters of which we have considered it more proper to place him.

Lucas Killian was born at Augsburg, A. D. 1579, and received the first rudiments of the art from his step-father, Dominic Custos, an artist of no great celebrity; he went early to Italy for improvement, and residing chiefly at Venice, he engraved several plates after Tintoretto, Paul Veronese, and other masters of that school. He possessed astonishing command over the graver; he derived his style evidently from the works of Goltzius and John Muller; his design is not, however, correct.

Several members of the family of Kilian have contributed largely to the art, viz. Wolfgang, his brother, born 1581; he imitated the style of Lucas, which he never equalled; his plates though neater, have not his freedom and vigorous execution: Bartholomew and Philip, sons of Wolfgang, Philip Andrew, grand-nephew of Bartholomew, another Wolfgang, and George Christopher; this last mentioned, flourished so late as the middle of the last century. Our readers will excuse this deviation from strict chronological order, as it was judged advisable to introduce their names (which is all our limits will admit,) into this place.

At this time flourished John Theodore de Bry, the eldest son of Theodore, whom we have mentioned above, an engraver of considerable merit; also his brother Israel an artist of inferior note: Tobias Stimmer, painter and engraver; his prints are chiefly on wood from his own compositions, which exhibit considerable taste and judgment, and his drawing of the human figure is correct; he executed a series of prints of his own composition from Scripture subjects, assisted by his brother Christopher and his disciple Maurer, which is usually called Stimmer's bible; this work is called by Sandrart "*A treasury of Science in the art of Painting*," and which Rubens declared he had studied with attention and much benefit: The works of his brother Christopher are executed in a style of great freedom, and are hatched in a bold but mellow style, and his drawing is correct. Christopher Maurer is also an artist of great merit.

Crispin de Passe, the elder, was born at Utrecht in 1560, and supposed to have been a pupil of Theodore Cuernhert. He drew well, and his plates, which are executed entirely with the graver in a neat and clear style, though not without some degree of stiffness and formality, are much esteemed, particularly his portraits. He was recommended by Prince Maurice to Louis XIII. of France. While at Paris, he published his celebrated work, "Instruction du Roi en l'exercise de monter à cheval, par Messire Antoine de Pluvinel." He likewise resided some time in England; but we shall have occasion to speak of him in another part of this article. He had three sons, Crispin, William, and Simon, and a daughter, Magdalene, who all practised the art with success.

Henry Goltzius was born at Mulbrecht, in the Dutchy of Juliers in 1558, and learnt the art from Theodore Cuernhert, an obscure engraver at Amsterdam; he then travelled to Italy, where the works of Michael Angelo, Raffaelle, and Polidoro da Caravaggio became the peculiar objects of his study and attention. Although he had a profound knowledge of anatomy, and drew the human figure with great spirit and accuracy, his compositions are frequently eccentric, and the attitudes and movements of his figures strained and unnatural, partaking in too many instances of the bombastic and extravagant manner which originated in Bartholomew Spranghe, and was followed by Goltzius and a few of his contemporaries; these defects are in some measure redeemed by the extraordinary beauty, clearness, and freedom of his execution as an engraver, which he so ably accommodated to the subject. Nothing places his powers in this respect in a more conspicuous point of view, (notwithstanding the general boldness of his style), than the success wherewith he imitated the works of Albert Durer, Lucas van Leyden, and the other German masters of their time, which, as evincing the extraordinary versatility of his genius, have been denominated "*The masterpieces of Goltzius.*" His engravings are numerous, amounting to more than five hundred plates, many of them of considerable size. The works he executed in Italy, are principally from the Italian masters; but on his return having settled at Haerlem, his plates are chiefly from his own composition, or from the pictures of the Dutch and Flemish masters. He also executed a few cuts in wood.

John Muller, born at Amsterdam in the year 1570, was the disciple of Goltzius, whose style he imitated. Although he is inferior to his preceptor, and his design is neither tasteful nor correct, his plates exhibit a wonderful freedom and facility in the management of the graver, and in this respect are admirable examples for the study of such artists as would wish to attain mechanical excellence. He executed some portraits which are much esteemed.

Abraham Bloemart, born at Gorcum in Holland about the year 1564, was a painter and engraver. His plates are not numerous, but he has left a few etchings in the style of pen-drawings, executed in a bold and masterly style, and several works in chiar' oscuro, with an etched outline, according to the process of Mair which we have described above; they have a fine effect, and are much esteemed. His two eldest sons, Henry and Adrian, were painters, the third, Frederick, was born at Utrecht about the year 1600; he has left many etchings and chiar' oscuros; but his principal work was a drawing-book, containing one hundred and seventy-three plates from the designs of his father. But the most eminent engraver of this family is Cornelius, the youngest son of Abraham, born at Utrecht in the year 1603. Having studied the principles of design under his father, he devoted himself entirely to engraving; he was first a disciple of Crispin de Pass; in 1630 he went to Paris, where he distinguished himself by the plates he engraved for "The Temple of the Muses;" he afterwards travelled to Rome, where he resided the greater part of his life. His plates are greatly esteemed for the beauty of their execution; but he particularly merits our attention from the great improvements he introduced into the art; before his time, it had been usual to leave the lights entirely untouched, without attempting to express their delicate variety of tints and their tender gradation into the shadows, so essential to the unity and breadth of general effect, the perfection of chiar' oscuro, and the truth of local colour; by discovering and supplying these defects in the established practice, he laid the foundation of that finished excellence which appears so conspicuously in the great masters of the French school, G. Audran, Picart, &c. and which forms so striking a characteristic in the improvements of modern engraving. C. Bloemart died at Rome in the year 1680.

The family of the Sadelers demand our notice in this place. John Sadeler was born at Brussels in 1550. He was originally an engraver of ornaments on steel and iron, which afterwards he inlaid with gold and silver. Having applied at an early period of his life to the study of the human figure, he acquired a considerable correctness in drawing. His early works have much of the dry manner of his country; but having travelled to Italy, where he settled, he improved his taste. He wrought entirely with the graver, which he managed in a clear, neat, and masterly style, and the expression of his heads is very fine. His plates are numerous, and consist both of portraits and historical subjects, in both of which he was equally successful.

Raphael was the younger brother and disciple of the preceding artist, along with whom he settled at Venice. His style does not differ materially from that of his brother; his plates are numerous and much esteemed. Egidius or Giles Sadeler, born in 1570, was the nephew of the two last-mentioned, under whom he studied, and whom, in a short time, he excelled. He had astonishing command of the graver, which he accommodated with taste and judgment to the nature of the subject; sometimes executing his plates with the utmost neatness, sometimes with the greatest boldness and freedom. Justus was the son of John; he studied under the three former; and Raphael the younger, son of the other Raphael, engraved in his father's manner. Mark seems only to have been a printseller, and the publisher of Giles' works.

James Matham was born at Haerlem in 1571. He was the son-in-law of Goltzius, under whom he was instructed in the art. He lived some time in Italy, and engraved, during his residence there, several plates from the Italian masters. On his return he executed many plates under the eye of Goltzius, from the principal masters of the Low Countries. His works are done solely with the graver, and exhibit great freedom and facility. His drawing is not correct. His son, Theodore, was also a respectable artist. He travelled to Italy, where he became a disciple of Cornelius Bloemart. On his return to Holland he engraved many plates, principally portraits, with the graver, occasionally assisted with the point, in a clear and free style. Adrian was another artist of the same family, born about 1600, but of inferior note.

John Saenredam was born at Leyden about 1570. He appears to have studied under Goltzius. His engraving is bold and clear, but his drawing is not correct. Several of his plates were of his own composition, which prove him to have been a man of taste and genius.

Theodore and Cornelius Galle, sons of Philip Galle, a native of Haerlem, were also respectable engravers of this time; the elder born at Antwerp in 1560, and the younger about 1570. Having received the first instructions in that art under their father they successively visited Italy, where, by the study of the antique, and the works of the great masters, they reformed and purified their style from the dryness of manner which their early works exhibit. Cornelius is the most esteemed of this family; after his return to Antwerp, he executed many plates after Rubens and other masters of the Flemish school, as well as from his own designs, chiefly historical subjects and portraits. Cornelius Galle, the younger, was the son of the elder Cornelius, born about 1600, also an artist of considerable celebrity. It does not appear that he ever visited Italy. His drawing is not so correct as that of his father; his plates, however, display great freedom and clearness, particularly his portraits, which are most esteemed.

The genius of Rubens at this time, bursting asunder the bonds of Gothic dryness and insipidity, from which the other artists of his country had not yet altogether emancipated themselves, displayed a fertility of invention, chastened by learning and taste, a feer and flowing outline, (although with a design by no means pure,) a brilliancy and splendour of colouring and effect, which had never yet been seen out of Italy, and successfully rivalling the works of Titian and the great masters of the Venetian school. These became the next object of the attention of the engravers, and were now of less difficult attainment, from the great freedom and boldness which Goltzius had introduced, and the harmony and breadth of which Cornelius Bloemart had given so many excellent examples. The chief artists of this school, which we may call the school of Rubens, are the Bolswerts, the Vostermans, and Pontius. Boetius Adam Bolswert was born at Bolswerd in Friesland, in 1580. It is not known under whom he received his first instructions, but his earlier works are executed in the free open manner of Cornelius Bloemart. In his later works after Rubens, he has given a higher degree of finishing, and considerable strength of local colour. They are executed entirely with the graver. His brother, Scheltius, was born also at Bolswert about 1586. He settled along with him at Antwerp, and became one of the greatest masters of that school. He executed many plates after the Flemish masters; but he is particularly distinguished by the beauty of his engravings after Rubens and Vandyke, which give all the force and variety of colour of which the art of engraving is susceptible. He engraved, with equal success, historical subjects, huntings, landscapes, and portraits.

Lucas Vosterman was a native of Antwerp, born about the year 1580. He first studied painting in the school of Rubens, by whose advice he afterwards devoted himself entirely to engraving, and executed some of the finest prints that have been taken from his pictures. He wrought with the graver only; and with this instrument he has been singularly successful in transfusing into his works the force and spirit of the originals; and his plate of the Adoration of the Magi is esteemed one of the finest productions of the art. During the reign of Charles I. he visited England, and executed several plates under the patronage of that monarch and the earl of Arundel. Lucas Vosterman had a son of that name, born at Antwerp in the year 1605. Notwithstanding the great opportunities of improvement which he enjoyed under his father, he never rose above mediocrity.

Paul Pontius, born at Antwerp about the year 1596, was instructed in the art of engraving by the elder Vosterman; but he improved his design by the advantages which the advice and friendship of Rubens afforded. He was singularly happy in the correct and faithful delineation of his model, and in conveying the character and expression of his figures. Without the facility of Bolswert, or the delicacy of Vosterman, his plates are executed in a style of great clearness and strength, and are undoubtedly among the most esteemed works of the masters of that school.

Peter Soutman, born at Haerlem about the year 1590, was a disciple of Rubens, and is said to have painted history and portraits with great success; but he is best known by the engravings he has left after Rubens and the other Flemish masters, as well as from his own designs. His plates are executed with neatness and spirit, and in a very peculiar style. In order to represent the extreme brilliancy of the lights, breadth of effect, and juiciness of the carnations, so remarkable in the pictures of Rubens, he has tinted them with delicacy and care, while he contrasted them with the shadows in a style of great depth and clearness, and giving to the whole much of the character of the originals. By carrying his principles too far, his lights have often a considerable degree of flatness, highly injurious to the character and detail of the parts. Although his plates have not the boldness and fire of Vosterman or Bolswert, they evince a thorough knowledge and right feeling of the subject. He has also executed a series of portraits of the counts of Flanders, in conjunction with his scholars Suyderhoef, Louys, and Van Sompel.

Peter Van Sompel, born at Antwerp about the year 1600, was a disciple of Soutman above-mentioned. He engraved several historical subjects after Rubens, and many portraits, in the style of Soutman, with much success.

Jonas Suyderhoef, a scholar of Soutman, was born at Leyden about the year 1600; he adopted the style of his master, which he improved. His plates, although finished with uncommon neatness, have a powerful and pleasing effect, and exhibit a perfect intelligence of the chiar' oscuro. He advanced them considerably with the point, and finished them with the graver. They consist of historical and other subjects, and portraits, and are held in great estimation.

John Louys, also a disciple of this school, born about 1600, adopted the style of his master with great success. He made considerable use of the point, and gave great delicacy to his carnations by expressing them with dots, instead of hatching them with lines.

Peter de Jode, the younger, born at Antwerp in 1606, whose father and grandfather had been also engravers in that city, was an artist of considerable ability. He engraved many portraits and historical subjects after Rubens, Vandyke, &c.; and although he never equalled Vosterman or Bolswert, he holds a very respectable rank as an artist of that school.

In enumerating the engravers who have sustained the credit of this school, we cannot in justice omit the name of Christopher Jegher, an artist who engraved solely on wood. His cuts are accurate transcripts of Ruben's pen-drawings, and are executed even in the cross-hatchings with great spirit and most wonderful effect. He is amongst the last of those who executed wood-cuts with the cross-hatching; a process which has been the source of much investigation of late years, and which seems to have been completely lost.

The etchings of Vandyke are ranked among the finest specimens in this department of the art. The principal of these are the *Ecce Homo,* his own design,—and Titian and his Mistress, from a picture of that master. The others consist of portraits of eminent painters of Antwerp, and form part of the celebrated collection of portraits of artists and amateurs, engraved by Bolswert, Pontius, Vosterman, and other celebrated engravers of that school, from the pictures of Vandyke. His etchings have a strong expression and character; the heads have a fine air; the hands are finely marked, and the whole executed with the greatest spirit and boldness.

William de Leeuw, also a disciple of Soutman, was born at Antwerp in 1610. He adopted a style of great freedom and boldness, which is often coarse and unharmonious; he engraved many large plates after Rubens, particularly hunting-pieces, for which his style was well adapted. His plates are executed principally with the point, and assisted with the graver.

Cornelius Visscher, also a scholar of Soutman, was born at Haerlem about 1610. He did not, however, follow the style of his master, but adopted one of his own, which he carried to great perfection. He drew with correctness and taste; and the plates which he executed from his own designs are esteemed the best of his works, and sufficiently attest the greatness and versatility of his genius. His execution is clear and delicate; and in some subjects, such as the drolls and conversations of Ostade, Bamboccio, Berghem, and the like, he has most happily united the freedom and spirit of a painter's etching with the more regular style of a finished engraving; and indeed he has never been surpassed in the talent of harmonizing the operation of the point with that of the graver. His portraits, familiar subjects, and cattle-pieces, are inimitable productions of his genius; but he was not so successful in the more elevated walk of history, of which he has left many examples from the works of Italian and Flemish masters, as for this his style was not so well adapted.

John Visscher, his younger brother, born about the year 1650, was also an engraver of considerable genius. His plates are not so highly finished, being carried farther with the point, but his style of etching is picturesque and spirited. His plates after Berghem and Ostade are much esteemed; and his portraits exhibit much skill in the management of the graver.

Lambert Visscher, supposed also to have been a brother of Cornelius, was likewise an engraver. He flourished about the year 1660. He resided several years in Italy, and engraved some historical plates and also some portraits.

Nicholas John Visscher, probably of this family, was an engraver and printseller in Amsterdam. He executed a variety of landscapes, cattle-pieces, &c. in a spirited and slight manner.

In the department of engraving, properly so called, the Flemish and Dutch schools offer nothing further of importance for our consideration; but as the painters of this time also distinguished themselves (and some of them in a most extraordinary degree,) in the use of the graver and point, we cannot dismiss this part of the subject without giving some account of the most eminent of these artists, among whom Rembrandt stands conspicuous.

We have already noticed, in a former part of this article, the character of this extraordinary person considered as a painter. As an engraver, however, he also merits particular attention, and his style forms a very remarkable era in the history of the art. The etchings of Rembrandt consist of historical subjects, portraits, and landscapes. In these he has united the most glaring defects with the greatest excellencies; destitute of the refinement of liberal education, and without a scientific knowledge of the human figure, his conceptions are gross and vulgar, and his design incorrect, bordering on deformity; the boldness and originality of his genius triumphed over these defects, and in the department of chiar' oscuro established a style of art, uniting the utmost brilliancy and splendour with strong sentiment and expression. The historical subjects exhibit wonderful skill in the management of his light and shadow; his heads, though of a coarse and undignified character, are full of expression; but what places his talents as an engraver in the most extraordinary light, is the amazing faculty he possessed of accommodating his style to the various qualities of surface of the different substances he represented, and the richness, variety, and interest which he thereby gave to his works. His portraits are executed with the utmost spirit, character, and expression; and his landscapes, whether in the general splendour, or the transient bursts of sunshine, or the solemn stillness of twilight, display a feeling and sentiment highly poetical; and even in his slighter works, executed with little more than an outline, every touch of his point teems with nature, character, and expression. His etchings are generally executed with the aquafortis, assisted with the dry point, and occasionally with the graver, but many of his heads are done entirely with the dry point. His plates are very numerous, and in very different degrees of finishing.

The style of Rembrandt was imitated by many of his pupils with much ability, but has never been equalled by any of them; of his scholars or imitators, the most distinguished are Van Vliet, Ferdinand Bol, John Lievens, and Lutma.

John George Van Vliet etched from the pictures of Rembrandt, of J. Lievens, and from his own designs. His plates have a surprising effect, his lights are broad and clear, and his shadows deep; his drawing is correct, but his draperies clumsy and mannered; his prints are much esteemed. The etchings of Bol are executed in a bold and free manner, and his light and shadow judiciously managed; and though not equal to Rembrandt in his lightness of touch and tasteful execution, they are works of great merit. John Lievens, though not a scholar of Rembrandt, imitated his style, and in many instances was little inferior to him; his principal plate is *The raising of Lazarus*, from his own composition, a work conceived with great taste, thorough intelligence of the chiar' oscuro, and executed with great mechanical skill and picturesque effect. His plates are partly etched and partly finished with the graver, and amount to about sixty.

Janus, or John Lutma, a goldsmith at Amsterdam, also executed two portraits in the style of Rembrandt, which are much esteemed; but he is chiefly celebrated for his plates in the style which he called *opus mallei*, or the work of the hammer; it was executed by means of punches and chissels, struck upon the plate with a hammer; they have a soft and agreeable effect, and are very rare.

Among the etchings of the Dutch masters, the landscapes of Both, Swaneveldt, Waterloo, Ruysdael, are the most esteemed. The cattle-pieces of Paul Potter are the finest specimens of drawing in this department, and exhibit the greatest truth of nature, joined to a thorough knowledge of anatomy, and an admirable style of drawing. We have also several sets of small cattle-pieces after his designs, etched by Mark de Bye, wherein all the truth and character of the originals are admirably preserved, and, next to the works of Potter, are the finest examples of scientific drawing which the Dutch school has produced.

The etchings of Karl du Jardin, Adrian Van de Velde, Nicholas Berghem, Albert Cuyp, Peter de Laer, &c. are also much esteemed; but their animals, tho' of spirited execution, are, in point of truth and minuteness of anatomical detail, greatly inferior to those of Paul Potter. We have also numerous etchings of drolls, conversations by Ostade, Brouwer, Teniers, Bega, Du Sart, and others.

Before concluding this part of the subject, we feel ourselves particularly called upon to enter into some consideration of the works of Count Goudt, born at Utrecht in 1585. This distinguished amateur, on visiting Rome, formed an intimacy with Adam Elsheimer, whom he greatly esteemed and patronized; and having bought many of his works, on his return to Holland executed engravings from seven of them, which form the whole work of Count Goudt. The pictures of Elsheimer were landscapes, exhibiting in general some particular effect of fire or moon-light, sun-rise, twilight, or the like, with appropriate figures, conceived with great purity, and drawn with taste, truth, and spirit. The engravings of Count Goudt convey, with great truth, the character and effect of the pictures; they are executed in a dark, but delicate and tasteful manner, with great minuteness of detail, as well as breadth of effect; the heads are graceful, and the figures are finely drawn. His plates are executed entirely with the graver, with great neatness, and in a manner peculiar to themselves; the effect of the deep shadows is not produced by increasing the strength of the line, but by repeated crossings with thin and delicate lines. In some parts of his plates, and particularly in that called the Sorcery, there is a considerable degree of harshness, from the strong opposition of the lights and deep shadows; in the best impressions, however, where the delicate tinting of the lights has not been worn away, this defect is not very conspicuous. John Van de Velde, besides many etchings, has left several plates, engraved in a style very closely resembling those of Count Goudt. He was born at Leyden in the year 1595.

The Dutch school, from this time, presents nothing very striking or particularly worthy of our consideration; and as, in the very contracted view which we have now given, we have been necessarily limited in our details, we have omitted many names which stand high in the ranks of art, restricting ourselves to the office of indicating the progress of improvement, from its primeval rudeness and barbarity to the perfection which it attained in later times.

In our classification of the subject we have deviated from the usual arrangement, by including under the same head what are called the German, the Flemish, and the Dutch schools. In this we conceive ourselves justified from the sense attached in common language to those several terms, which seem to indicate rather different eras and changes of style of the original school whence they all drew their design. Thus Lucas Van Leyden, though a native of Holland, we conceive to be appropriately classed with Israhel van Mekenen and Albert Durer, to both of whom his style is in some respects to be referred, while many of the German artists having fixed their residence in Italy, and acquired the taste of that country, come more properly under the classification of the Italian masters.

By the term German school, in its restricted sense, is frequently understood the masters who flourished during the early ages of engraving, the characteristic of whose style is dry and gothic; by the Flemish school is understood that era when these defects began to disappear, and a more enlarged style and flowing outline was attained towards the end of the sixteenth century; while by the Dutch school is understood that class of artists of Holland and the Low Countries, who represented the appearances of nature in her familiar and unselected form, rural landscapes, cattle, marine subjects, conversations, drinking scenes, and the like.

Sect. III. *Italian School.*

We have already, in another place, taken a view of the claims of the Italians and Germans to the invention of taking impressions on paper from engraved metallic plates, attributed by the Italians to Finiguerra, and at the same time noticed the probability of the art having been known in Germany before that time, while, from the limited intercourse between the two countries, it might have been discovered and practised by both, without this being known to each other. The date of the discovery of Finiguerra, is fixed by Vasari in the year 1460.

The works of Finiguerra are extremely scarce, and are not identified by any direct evidence. There is, however, an impression of *Christ led to be crucified*, lately discovered, about the size of 11 inches by 7, which was sold by public auction in London, at the enormous sum of L.84 Sterling.

Baccio Baldini, a Florentine goldsmith, born about the year 1436, was instructed in the art by Finiguerra; little more is known of his history, than that he executed 19 plates from the designs of Sandro Boticelli, for an edition of Dante's *Inferno*, printed at Florence by Nicolo della Magna in 1481. These plates are executed in a very rude style, and very indifferently drawn, though the draperies are cast with much simplicity.

Sandro Boticelli, who had been also a goldsmith, afterwards studied painting under Filippo Lippi; he also executed a few plates for the above-mentioned edition of Dante and other works. This edition of Dante is usually considered to be the earliest printed book embellished with copperplates; but there is, in the library of Earl Spencer, a book printed at the same press, containing plates by the same artist, dated 1477, four years earlier than this; it is entituled, '*Monte Santo di Dio.*' The author was Antonio Bettini, bishop of Fuligno. It contains three plates, one of which is considerably larger than the embellishments of Dante.

Antonio Pollajuoli, also a native of Florence, was born about the year 1426. He is the first of the Italian engravers whose works may be considered worthy of any critical examination. He seems to have aimed at anatomical precision, and commonly represented his figures naked. Though his drawing is by no means correct, his heads are not without expression, and there is evidently displayed an attempt at a higher style of art than his contemporaries had attained to. The plates of this master amount only to three, viz. a very large plate, representing ten figures fighting with swords and other weapons,—the background is a forest, the figures are about eleven inches high each: *2d*, A Holy Family, with Joseph, St Elizabeth, and St John: *3d*, Hercules strangling Antæus. Pollajuoli also wrought in bronze, and assisted Ghiberti in some of his great works.

Andrea Mantegna, born at a village near Padua in 1431, was a painter and engraver. He had received the first initiation into the arts of design from Francesco Squarcione, a painter who had founded the most distinguished academy of art of that time, and, by a journey through Greece, as well as by his researches in Italy, had obtained a considerable collection of statues and bas-reliefs, the study of which had a very decided influence on the taste of Mantegna, who thus acquired a pure and correct design, and a simplicity of composition which had not been seen before since the revival of the arts. His plates are executed in parallel lines lying diagonally, without hatchings or crossings, like pen drawings. As the other engravers of this period did nothing to advance the art, and were also in general deficient in correctness of design, they do not merit any particular attention; we shall therefore only record their names: Fra Giovanni Maria da Brescia, a goldsmith, painter, and engraver; he became a friar of the order of the Carmelites. Giovanni Antonio da Brescia, said to have been brother of the preceding, and also a disciple of Andrea Mantegna; he was also a Carmelite friar. Nicoletta, or Nicolas da Modena, is one of the earliest engravers of the Lombard school; his works are extremely rude in every respect. Hieronymus Mocettus, or Jerome Mocetto of Verona, was an engraver both on wood and metal; his drawing is very defective. Robetta, according to Huber, was born at Florence; he executed a few plates, also in the rude manner of this time. Benedetto Montagna, a native of Vicenza, seems to have been a disciple of Giovanni Bellini the painter; his plates bear some resemblance to the earliest works of Marc Antonio, and are very defective in design and execution.

We now come to a more brilliant era in the art, when the genius of Raffaelle and Michael Angelo shed a lustre over the arts of painting and sculpture, dissipated the Gothic dryness of their predecessors, and communicated to the engravers of this era no small portion of their purity of design, expression, grace, and energy.

Ugo da Carpi, a painter and engraver, was a disciple of Raffaelle, but is principally celebrated for his engravings; they are executed in the chiar' oscuro manner, and if not its Italian inventor, (for we have already stated our conviction that before this time it had been practised in Germany) he was at least the first who practised it in Italy. His engravings usually consist of three blocks, an outline, middle tint, and deep shadows; they are executed in a bold broad style, and acquire an additional value from their being mostly taken from the designs of Raffaelle, Parmeggiano, and other great masters of that time.

Dominico Beccafiumi, or Micarino, born at Sienna in 1484, was a painter in oil, distemper, and mosaic, and an engraver. Having improved his taste by the most assiduous and attentive contemplation of the works of Michael Angelo and Raffaelle at Rome, he returned to Sienna, where he executed many very considerable works. His engravings are in every manner then known; his wood cuts and chiar' oscuros, some of them after Titian, are most excellent; and his etchings and those plates executed entirely with the graver, though not remarkable for neatness of handling, shew the touch of a great master.

Marc Antonio Raimondi, was born at Bologna about 1488. He was originally a goldsmith, but learnt drawing under Francesco Raibolini, called also Francia; at the early age of 15, he engraved the plates of the four heroes, and Pyramus and Thisbe, which, though greatly inferior to his best works, had not been equalled at the time. Having gone to Venice for improvement, he first saw the works of Albert Durer, which used to be imported from Germany. He is said, by Vasari, to have copied the wood-cuts of Albert Durer on copper, and to have passed them as the originals, which, coming to his knowledge, he instituted a prosecution against him before the senate of Venice. From this place he went to Rome, where his talents speedily recommended him to Raffaelle, who engaged him to engrave from his designs, and formed with him a close intimacy and friendship, equally conducive to their mutual advantage, and to the great interests of the arts of design. His first plate after Raffaelle was the death of Lucretia, which, though not among his best works, is executed in a style of great neatness; he next engraved the Judgment of Paris in a style of great freedom and boldness; and these were followed by several other plates which completely established his reputation. During the life of Raffaelle, he executed no plates after the designs of any other master; but after his decease he executed many engravings from the designs of Michael Angelo, Giuglio Romano, and other great masters of the Roman and Florentine schools. Amongst other subjects, he unfortunately executed, from the designs of Giuglio Romano, a set of obscene subjects, accompanied with verses by the poet Aretino, which having excited the indignation of Pope Clement VII. he was arrested and thrown into prison, from which, by the powerful intercession of several of the cardinals, and the good offices of Baccio Bandinelli, he was with difficulty liberated. As an acknowledgement of his gratitude towards Bandinelli, he engraved, from the design of that painter, his celebrated print of the martyrdom of St Lawrence. This is one of his largest and best plates, and having corrected the drawing of the original, is in this respect much superior to the usual productions of Baccio Bandinelli. The admiration it excited not only procured from the Pope full pardon for his former offence, but also his special patronage and protection. On the sacking of Rome in the year 1527, he was plundered of all his property and obliged to take refuge in Bologna, where he continued to practise the art till 1539, which is the date of his last print,—the battle of the Lapithæ, after Giuglio Romano. Marc Antonio was certainly one of the greatest engravers that ever lived, whether we consider the wonderful purity of his design, the character and expression of his heads, or the firmness and vigour wherewith he marked the extremities; the principles of chiar' oscuro, and the representation of local colour as connected with engraving, were at that time utterly unknown; but there is in the execution of the individual parts, a delicacy, roundness, and harmony, which no other engraver of that time ever attained. As the plates of Marc Antonio came successively into the possession of several different publishers, and being much esteemed were in great request, they have been so frequently retouched, that the last impressions have nothing of the character of the original state of the plates; it is only in the first impressions that their great beauties must be looked for; these are marked with no publisher's name; the state of the plates will be best indicated by the publisher's names in the following order: Tommaso Barlacchi, Antonio Salamanca, Antonio Lafreri, Nicholas Van Aelst, and, lastly, Giacomo Rossi, or de Rubeis, at which time they were completely worn out.

The fame of Marc Antonio attracted many artists from all parts of Italy and Germany; and although he was not equalled by any of his disciples, they at least maintained the reputation of his school. The most distinguished amongst them are, Agostino de Musis, Marc di Ravenna, Giuglio Bonasone, Nicolo Beatrici, and Enea Vico, Italians; and Bartholomew Beham, James Binck, and George Penz, from Germany, from whom we cannot withhold the honour of classing among the masters of the Italian school.

Agostino de Musis commonly known by the name of Agostino Veneziano, was born at Venice about the year 1490. From one of his earliest engravings being dated 1509, he is supposed by Mr Strutt to have been a disciple of Marc Antonio while he resided at Venice; it is certain that he studied under him at Rome, and wrought in conjunction with him on some of his plates. He died about the year 1540.

He imitated the style of Marc Antonio, as to the execution of his plates, with great success; but in point of taste and sound design he is greatly his inferior. He frequently introduced, in the working up of his flesh, a dotted style of shading instead of the usual manner of representing this by parallel lines, resembling what has in modern times acquired the name of stippling or the chalk manner.

Marco Ravignano, commonly called Mark of Ravenna, born in that city in the year 1496, was a disciple of Marc Antonio, contemporary with Agostino Veneziano; during the life of Raffaelle those two latter worked together under Marc Antonio, but after his death they seem to have been employed solely on their own account, and from this time their plates are marked respectively with their own cyphers. He imitated with great accuracy the bolder manner of Marc Antonio, but was not equally successful in his more delicate and neat style; his drawing, without the purity which so eminently distinguishes his great preceptor, is correct, but the extremities of his figures are deficient in his firmness and energy. He died at Rome about the middle of the sixteenth century.

Giuglio Bonasoni, born at Bologna about the year 1498, studied painting under Lorenzo Sabbatini, and executed many fine pictures for the churches in Bologna; but is best known as an engraver after Michael Angelo, Raffaelle, Giuglio Romano, Parmeggiano, as well as from his own designs. Although his style is neither so clear and masterly, nor his outline so pure as those of his instructors, his works are executed with great facility and elegance, and entirely with the graver.

Enea Vico, born at Parma about the year 1512, is said to have been instructed in design by Giuglio Romano; he learnt engraving under Marc Antonio, by whose reputation he was attracted to Rome. He perfectly understood the design of the human figure; but, from the impetuosity and impatience of his character, he seems to have neglected beauty and correctness of form, as well as the careful execution of his plates, so ably exemplified by Marc Antonio. He also executed several wood cuts, in a very masterly manner.

Giovanni Battista Franco, was born at Venice in 1498; after having studied the principles of design he went to Rome, in order to complete his education by the study of the great works of art in which that capital abounded. He possessed a fine taste in drawing, and a profound knowledge of anatomy. According to some authors he learnt engraving under Marc Antonio, and according to others under Giuglio Bonasoni. His style is grand and tasteful, and, though it is believed he wrought entirely with the graver, his plates have often the appearance of being etched.

Bartholomew Beham of Nuremberg we have already mentioned, along with the masters of the German school; he is one of the most successful imitators of the style of Marc Antonio, his drawing is correct, and his heads have a fine expression.

James Binck of Cologne, born in 1504, was originally a disciple of Albert Durer, or Aldegrever, but coming to Rome he improved himself under Marc Antonio; his style is not uniform, it is always neat, and displays great freedom of execution; his drawing is correct, and there is an agreeable taste in his figures; but although he resided the greater part of his life and died at Rome, he never entirely relinquished the manner of the German masters.

Gregory Peins or Pentz, was born at Nuremberg in 1550, and received his first instructions under Albert Durer; he came to Italy, and engraved, along with Marc Antonio, many plates after Raffaelle. His drawing is tasteful and correct, and his plates are neat and delicate, and have nothing of the character of the German school; they are from the pictures of the Italian masters, as well as from his own designs.

Nicolo Beatrice, born at Thionville in Lorraine in the year 1500, came to Rome and studied under Marc Antonio or Agostino Veneziano; his drawing is not correct, and his style of engraving is not remarkable for any great beauties; but his plates derive considerable value from being taken from the pictures of Raffaelle, Michael Angelo, and the other great masters of that school.

At this time flourished Luca Penni, a native of Florence; he was a painter and engraver, and studied under Raffaelle and Perino del Vaga. He travelled to England, and was employed by Henry the Eighth, from whence he went to France, and resided for some time at Fontainbleau. On his return to Italy he devoted himself to engraving and etching, and executed many fine plates from the works of Rosso and Primaticcio, as well as from his own designs, His plates are executed in a very spirited style, and finely drawn; they are mostly done with the point, but also occasionally with the graver.

Francesco Mazzuoli, commonly called Parmeggiano, whom we have already mentioned as a painter, also executed several etchings, he was born at Castel Maggiore, A.D. 1505. His plates have all the grace and elegance characteristic of his pictures, but in point of execution they are very defective. As before his time the art of etching was hardly known in Italy, and his etchings being so imperfect, he has often been mentioned as the inventor of this branch of the art, although it is certain that it had been practised by the masters of the German school before his time. As his plates are ill bit with the aquafortis, and exhibit a total ignorance of the necessary mechanical skill, it would appear that he must have learnt what he did know of it, only from report. Notwithstanding these defects, his plates are highly prized by the judicious collector. There are many wood-cuts after this master, which are usually attributed to him; but it is more probable that they were the work of Ugo da Carpi, Andrea Andreani, and his own disciple Antonio da Trenta, and other engravers. Parmeggiano died at the age of 35.

The family of the Ghisi of Mantua flourished at this time; and from the number and excellence of their works, they are well worthy of our particular notice. The first of them is Giovanni Battista Mantuano, a painter, sculptor, engraver, and architect, was born about the beginning of the sixteenth century, and is said by Vasari to have been a disciple of Giuglio Romano. He understood the human figure well, but his drawing is mannered, and his effect deficient in harmony; his style of engraving is not unlike that of Marc Antonio.

Giorgio Mantuano, son of the preceding, or, according to others, his nephew, was born in 1524. He acquired, under Giovanni Battista, the principles of design and the art of engraving, but whose style he greatly improved; his drawing is correct and scientific, and the extremities of his figures are finely marked, though they are chargeable with a considerable degree of manner and sameness, whereby the character of the originals is by no means faithfully rendered. His print of the Last Judgment, after Michael Angelo, is a remarkable instance of this; he has there, as well as in other works after this master, given to the drawing of the figures a great coarseness of character, by caricaturing the appearance of the muscles, whereby, to those who are not conversant with the works of Michael Angelo, his great style has been much misrepresented. These defects do not always occur, and they are greatly redeemed by their truth and beauty in other respects. Adamo Mantuano, the younger brother of the preceding, was born at Mantua in the year 1530; he drew the figures well, and executed many plates after the great masters of the Italian school, which, though inferior to his brother, are much esteemed. Diana Ghisi, called Mantuana, was the sister of the two preceding artists; she seems to have been intructed in the arts by her brother Giorgio, as her style bears a considerable resemblance to his. She has left many plates of very great excellence, after the great Italian masters, and which are much esteemed.

Giovanni Giacomo del Caraglio, or Caralius, called also Jacobus Veronensis, born at Verona in 1512, studied under Marc Antonio, whose style he imitated with great success; he is one of the most distinguished engravers of this school. His heads have a fine expression, and his drawing is correct. Giovanni Battista d'Angeli, called del Moro, was born at Verona in 1512; he chiefly devoted himself to painting, and was at first a disciple of Titian, and subsequently of Franciso Torbido, called Il Moro, whose name and fortune he inherited. His plates are etched in a slight and spirited manner; his drawing is correct, and the extremities of his figures are finely marked; they are principally after Raffaelle, and Parmeggiano, &c. He also executed, along with Battista Vicentino, a series of sixty landscapes in a very fine style, chiefly after Titian, which are much esteemed. Of this Battista Vicentino little is known. He was born at Vicenza sometime before the middle of the sixteenth century. The landscapes which we have just mentioned seem to be all that is known of his works.

Giovanni Nicolo Vicentino, called Rossigliani, born at Vicenza about the year 1510, was a painter and engraver on wood. His cuts are all executed in chiar' oscuro, after Raffaelle and Polidoro da Caravaggio.

Nicolo Boldrini, called also Vicentino, born at Vicenza, was an eminent engraver on wood. Of his history little is known; it is generally believed he was a disciple of Titian, from whose designs most of his cuts are taken. They are in a style perfectly original, without neatness or delicacy; they please and surprise by the bold, free, and masterly style of their execution: generally they are with single strokes, and occasionally with a little cross hatching. Some of his cuts have been attributed to Titian, but this is probably erroneous. Antonio da Trenta, born at Trenta, in the Venetian States, in the year 1508, was a painter and engraver; he is best known by the wood cuts which he executed after Parmeggiano, whose disciple he was. His cuts, though not highly finished, or possessing any minuteness of detail, are much esteemed for their spirit and boldness of execution.

Martin Rota, born at Sebenico in Dalmatia, in the year 1540, was an engraver of great merit. He resided chiefly at Rome and Venice. He drew the figure correctly. His plates are executed entirely with the graver, and, though not highly finished, are wrought in a neat clear style. He has left several portraits and historical subjects, both from his own designs and those of the great Italian masters. Among others, a plate of the Last Judgment, after Michael Angelo, which is much admired for the beauty of the execution, and the correct manner in which he has rendered the drawing of the original.

Federico Baroccio, born at Urbino in the year 1528, was a painter of great eminence. He was originally a disciple of Battista Franco at Venice; but removing to Rome, he studied the works of Raffaelle, whereby he greatly improved his style. He did several etchings from his own designs; his drawing is correct; his attitudes and movements of his figures graceful and elegant, and the airs of his heads almost rival Parmeggiano, from whom he seems to have borrowed some portion of his grace. And, although the beauty of his plates is considerably injured by the defective manner in which they have been corroded with the aquafortis, they have a fine and powerful effect, great contrast of colour, and light and shadow, united with breadth and delicacy. He died at Rome in the year 1612.

Cesare Vecellio, brother of the great Titian, was born at Venice about the 1530. He executed several etchings in a spirited manner; he engraved also on wood, from which circumstance it is probable that some of those cuts usually attributed to Titian are the work of this artist. Andrea Andreani, born at Mantua in the year 1540, was an eminent engraver on wood. His cuts are executed solely in the chiar' oscuro manner: at first he imitated the style of Ugo da Carpi and Antonio da Trenta; but, as he acquired greater power in the mechanical part of the art, he improved greatly on their style, and brought their works to a much higher state of finishing. His drawing is spirited and masterly; his heads characteristic and expressive, and he displays great judgment in the management of his tints. His prints are usually executed on two or three blocks, and have a fine effect; they are numerous, but there are many under his name, the blocks of which, having purchased, he retouched, and, adding his name or monogram, sold the impression as his own work. There are many other painters and engravers of this time who have practised the art with great success; but as their styles present nothing worthy of our particular consideration, we shall not occupy much time in noticing them in detail. Among these are Andrew Schiavone, called also Meldolla, a painter, who executed a few etchings and cuts in chiar' oscuro; Paulo Farinati; Battista da Parma, or Parmensis; Gaspar ab Avibus, or Patavinus; Giacomo Battista Fontano, and Dominico Maria Fontana; Giuseppe Porta, called Salviati; Giulio Sanuti; Bartolomeo Passarotti; Camillo Procaccini; Antonio Tempesta, &c.

Cornelius Cort, a native of Hoorn in Holland, born 1536, is usually classed with the masters of the German and Dutch schools; but as he resided long in Italy, (where he died,) acquired the pure and correct design of the Roman school, and by the new lights which he threw on the art, greatly improved the Italian school of engraving, we are of opinion that he is fully entitled to a place amongst the most distinguished artists of Italy. Cornelius Cort, on leaving Holland, resided for a considerable time at Venice, in the house of Titian, and there executed many very fine plates from the most celebrated pictures of that master: He afterwards removed to Rome, where he established a school, and produced many of those admirable works which reflect so much honour on his genius, and which formed a new era in the history of engraving. To a correct and vigorous style of design he added a bold, clear, and masterly manner of handling the graver, and great delicacy, harmony, and clearness of effect; his style differs from that of all his predecessors or contemporaries, in its greatness of manner, and its peculiar aptitude for subjects of large dimensions. Cort has executed a great number of portraits, and historical subjects, from his own designs, and after Raffaelle, Titian, and other great masters of the Italian schools. He has also the honour of having been the instructor of Agostino Caracci, and of Henry Goltzius, who introduced his bold style of engraving into the Low Countries, which was so successfully adopted by Vosterman, Pontius, and Bolswerd, and which forms the most striking characteristic of that branch of the Flemish school.

Agostino Caracci, brother of Annibale, and cousin of Ludovico Caracci, was born at Bologna in the year 1558. He was originally destined for the profession of a goldsmith; but having at an early age shewn great taste for the arts of design, he was persuaded by Ludovico to direct his attention to painting, and accordingly became a disciple, first of Prospero Fontana, afterwards of Bartolomeo Passarotti, and perfected himself in engraving under Cornelius Cort, whose style he imitated. His design is pure and correct, the expression of his heads is admirable, and his extremities are marked with great vigour and firmness, and his execution free, spirited, and harmonious; and it has been often said, that if he had paid more attention to the effect of his chiar' oscuro, his plates would have almost reached perfection. His plates are in general executed entirely with the graver; as a painter he holds a distinguished rank in the art; he also cultivated poetry and the sciences with great success.

Ludovico and Annibale Caracci have also left several plates, they are mostly etched and touched up with the graver, without the finishing of Agostino; they are valuable for the purity and taste of their design.

Cherubino Alberti, son of Michael Alberti, a painter, was born at Burgo San Sepolcro, in the year 1552; he was a respectable painter, and executed several works, in fresco and in oil, for the churches at Rome; but he is better known as an engraver. He is supposed to have learned engraving from Cornelius Cort, and afterwards to have studied under Agostino Caracci; he drew correctly, his heads have a good air, but his draperies are clumsy and stiff. His plates are executed entirely with the graver, in a bold and free style, and they are still more valuable as being in general taken from the works of the great masters of the Italian schools. We are further indebted to him for his plates after the works of Polidoro da Caravaggio, which had been painted as friezes on many of the public edifices of Rome, and which, being by their situation exposed to the inclemencies of the weather, have long ago disappeared; his plates are very numerous.

Francisco Villamena, born at Assissi in the year 1566, was an eminent designer and engraver. He acquired at Rome the principles of design, by studying the antique and the works of the great masters; he is supposed to have been a disciple of Cornelius Cort, under whom he learned the art of engraving. His drawing is correct, the airs of his heads are very fine, the effect of his plates is bold and clear, and he handled the graver with great facility.

At this time also flourished Guido Rheni, a disciple of the Caracci; he was born at Bologna in the year 1575; he has left a great number of etchings executed in a bold free style. His drawing is correct, and his heads graceful and expressive, and the extremities, though not much detailed, are tastefully marked, and well understood.

There are many other painters of this period who have left etchings of great merit, such as Sisto Badalocchio, Giovanni Lanfranco, Francesco Brizzio, Giovanni Francesco Barbieri, called Guercino, Giuseppe Ribera, called Spagnoletto, Odoardo Fialetti. The following engravers principally devoted themselves to wood-cutting and chiar' oscuro: Bartolomeo Coriolano, Leonardo Norisini, called Parasole, his son Bernardino, Raffaelle Scaminossi, &c.

Remigio Cantagallina, was born at Florence A. D. 1582. He was at first a disciple of the Caracci, but learnt the art of engraving from Giuglio Parigi; he was a reputable artist, but is chiefly celebrated for having been the preceptor of Callot and Della Bella, two engravers, whose originality of conception, and versatility of talent, entitle them to our very particular notice.

James Callot was born at Nancy in Lorraine, in the year 1593. He was descended from a noble family of that country, and was, contrary to his inclination, destined for a different profession; but his love for the art, which he could not indulge under his paternal roof, led him, at the age of twelve years, to join a company of wandering Bohemians, and found his way to Florence; here he found means to be received as a pupil of Cantagallina, under whom he studied design and engraving; he afterwards became a pupil of Giulio Parigi, and ultimately of Philip Thomassin. The works of Callot are generally on a small scale, and consist of portraits, battles, hunting-pieces, histories, fairs, processions, figures, landscapes, and topographical subjects,—but of their style an attentive examination alone can give an adequate idea. He delighted in such subjects as would admit a great variety of figures, which he drew with the utmost correctness and spirit, and to which he gave astonishing variety of attitude and gesture; his plates are executed principally with the point, in a most tasteful and spirited manner, and occasionally, though not always assisted with the graver; these tools he handled with wonderful judgment and taste, adapting the character of his strokes to the circumstances and situation of the various objects; by which means, without often aiming at the representation of much local colour, or strength of chiar' oscuro, his plates possess great distinctness and precision, as well as spirit and variety of character. He engraved chiefly from his own designs, but he also executed many works from the designs of other masters. Although he died at Nancy in the forty-second year of his age, his plates amount to the surprising number of fifteen hundred.

Stefano della Bella, the son of a goldsmith, was born at Florence in the year 1610. He first studied painting under Cesare Dandini, and subsequently became a pupil of Cantagallina; the subjects he chose were the same as those of Callot, whose style he at first imitated, but afterwards adopted one peculiar to himself. He handled the point with a spirit and delicacy in which he has never been surpassed, and his plates have a clear and brilliant effect; they amount to upwards of fourteen hundred.

Cornelius Bloemart, whom we have already noticed in another place, was born at Utrecht in the year 1603. Having settled at Rome, acquired the Italian taste, and engraved many plates after the Italian masters, we conceive that he ought to be also mentioned in this place. His drawing is correct, and his style of execution tasteful and clear; but what particularly gives him a claim to our admiration, is the improvement he introduced into the art, by producing more harmony and local colour; he was the first engraver who, by tinting the lights with delicate strokes, and uniting the shades into masses, gave full harmony to his plates, and laid the foundation of the great excellence of the French school of the time of Louis XIV. which gives so decided a superiority in point of effect to the productions of modern art.

We have now traced the history of the Italian school of engraving from its origin to what may be considered the perfection of the art. Marc Antonio acquired all the beauties which depend on design, viz. correct drawing, grace, elegance, and expression, and often added to these considerable beauty of execution; his style of handling, was, however, on the whole, dry and meagre. The pupils of Marc Antonio maintained the credit of his school, without adding any improvement of style. Cornelius Cort to scientific drawing gave a style of execution, bold, enlarged, and well adapted for works of large dimensions, a more powerful style of handling, and a more scientific manner of crossing the lines. His style was followed, and in some instances improved by Agostino Caracci; and the whole was perfected by Bloemart, by shewing the manner of tinting the lights, and giving all the variety and breadth of effect by the gentle degradation of the lights into the shadows.

Pietro Testa, born at Lucca in the year 1611, was a painter, but has left a considerable number of etchings of great merit. He possessed a vigorous and fertile imagination, which does not seem to have been at all times regulated by a sound judgment; his compositions are often extravagant, the subjects incomprehensible, and his attitudes forced and unnatural: although his drawing is not always correct, his heads, particularly those of his females, have a very fine air, and his figures frequently exhibit infinite grace and elegance. Some of his works, for example his Thetis bathing Achilles in the river Styx, possess a classical purity throughout; and his back-grounds and accessaries are often conceived with much grandeur and elevation of thought.

Giovanni Francesco Grimaldi, called *il Bolognese*, a landscape painter of great eminence, born at Bologna in the year 1606, was a relative and disciple of the Caracci; he has left a considerable number of etchings, after Titian, the Caracci, and from his own designs. They are executed with great spirit, and in a very chaste and classical style, like pen drawings; they are adorned with figures well drawn and judiciously introduced.

Claude Gelée, better known by the name of Claude Lorraine, born at the village of Champagne in Lorraine in the year 1600, was an eminent landscape painter; he has left several etchings of landscapes of great merit. Without the advantage of mechanical facility or neatness of execution, they recommend themselves to the intelligent critic by their purity of conception, their truth of nature, and the depth and scientific distribution of their chiar' oscuro. His trees are admirable, nay, unequalled for their richness, variety, and strength of character; and his etchings, on the whole, however repulsive to the sight of a superficial observer, will be found to possess more beauties the more attentively they are examined.

Gaspar Dughet, commonly called Gaspar Poussin, from his brother-in-law Nicolo, whose name he adopted, was born at Rome in the year 1613; he was a disciple of Nicollo Poussin, but devoted himself entirely to landscape-painting, which he cultivated with great success; he has left a few etchings, which, though not equal to his pictures, are works of great merit, and much esteemed.

Herman Van Swanevelt, a native of Holland, born in the year 1620, was originally a scholar of Gerard Douw, whose style he at first imitated; but, forming a decided predilection for landscape, while yet young, he went to Italy and studied under Claude Lorraine. He executed a great number of etchings from his own compositions, in a clear free style, possessing at the same time great depth of chiar' oscuro, and neatness of finishing. His compositions are often grand; but, in the representation of his trees, there is frequently no inconsiderable degree of manner, and they, in this respect, fall infinitely short of the truth and character of Claude.

Sebastian Bourdon, born at Montpellier in the year 1616, painted history and landscape with great success. Although a native of France, having gone early in life to Rome, and adopted the Italian taste, we conceive him fully entitled to a place among the masters of that school. While at Rome, he contracted an intimacy with Andrea Sacchi and Claude Lorraine, from whose instruction he derived considerable advantage. He possessed a fertile imagination and pure classical taste, finely adapted to the grand style of composition, in which he excelled. He has executed a great number of etchings, in a broad free style, and brought up to great power of effect with the graver. His drawing of the figure is not correct, but his subjects are finely composed, and his back-grounds are conceived with much grandeur.

James Rousseau, born at Paris in the year 1626, was a painter of landscape and perspective. Having gone to Rome, he formed an intimacy with Herman Van Swanevelt, whose sister he married, and by whose assistance and instruction he improved his taste, and became an artist of high reputation. His style of composition seems to have been derived from that of Nicolo Poussin; his landscape is conceived in a very grand style, and highly enriched with architecture; his etchings are executed in a bold, free, and clear style, and are much esteemed.

Salvator Rosa, born at Naples in 1615, was a painter of history and landscape. His drawing of the figure is destitute of correctness, grace, or elegance; his landscape usually represents the savage grandeur of mountainous scenery, inhabited by beings well suited to this wild solitude,—banditti and assassins. His etchings are generally of this kind, and are executed with great spirit, and corresponding in execution with the charracter of the subject.

Carlo Maratti, born at Camurano, in the marquisate of Ancona, in the year 1625, was a historical painter of great eminence. He had been originally a scholar of Andrea Sacchi, but he improved himself by the study of the great works of Raffaelle. He has left a number of etchings, executed with great spirit, and in a style of much higher finishing than is usually found in the engravings of painters. His drawing is very fine, his heads have a fine air, and the effect of his plates is well made out. They are both from his own designs and from the pictures of the great masters of the Italian schools. Some of them are very large; and one of them, '*Heliodorus driven out of the Temple*,' after Raffaelle, is on two sheets; they are highly esteemed.

James Frey, a native of Lucerne in Switzerland, born in 1681, was an engraver of great eminence. He was first a disciple of Westerhout, and was afterwards received into the school of Carlo Maratti, under whom he made such rapid improvement that he in a short time became one of the first artists of the age in which he lived. He drew the human figure with great skill and accuracy, and gave to his plates great harmony and effect. They are etched in a fine rich and clear style, and brought to greater colour and depth by means of the graver, and he conveyed with great truth the character of the master he engraved from.

Pietro Santo Bartoli, born at Perugia in 1635, was an engraver of great merit. His plates are chiefly etched, and in a very bold and masterly manner, and well drawn; but, besides their intrinsic merits, they also particularly recommend themselves to us, as being interesting memorials of the most valuable remains of antiquity, relievos, ancient sculptures and pictures, of many of which no other record now exists. Amongst many others, he executed what is called the Admiranda, in eighty-three plates, consisting of the choicest remains of ancient sculpture discovered at Rome; the Antonine column, in seventy-eight plates; and the Trajan column, in one hundred and twenty-eight plates, &c.

Count Antonio Maria Zanetti, was born at Venice in the year 1680. This nobleman having studied the arts of design solely as an amusement, formed so strong an attachment to them, that he dedicated much of his time and attention to their cultivation; and, in the department of art which he chose, he must be ranked with its most successful professors. He executed, with the assistance of his relation Maria Zanetti, a great number of etchings and chiar' oscuros, after the drawings of Raffaelle, Parmeggiano, and other great masters of the Italian school; they are well drawn, and the effect of his wood-cuts is very fine; they consist in all of about one hundred plates.

Antonio Canale, commonly called Canaletti, was born at Venice in the year 1697. He was an admirable painter of architectural scenery; he gave to his pictures amazing brilliancy of effect, and clearness and transparency in the handling. He executed a great number of etchings in a style of much beauty and freedom, wherein he has expressed with wonderful talent the clearness, transparency, and spark-ling effect of light of the pictures. He executed them almost entirely with parallel lines without crossing; but by variety of character and strength of effect he has produced in that department some of the most original works of which the Italian school can boast.

Giovanni Marco Pitteri, born at Venice in the year 1703, was a disciple of Faldoni, an engraver of great merit at Venice. The plates of Pitteri are executed in a very whimsical manner, the effect being produced by means of parallel lines running from top to bottom, which are strengthened in the shadows according to the depth required, without crossing or in any way following the direction of the surface of the different objects. Notwithstanding their singularity of style, the works of Pitteri possess great merit, and have a very agreeable and harmonious effect. They consist of portraits, many of them on a very large scale, and historical subjects after the Italian masters.

Giovanni Battista Piranesi, born in the Roman territory in the year 1707, was a distinguished antiquary and engraver. It is not known under whom he studied, but his style is perfectly original. His plates consist of the architectural remains of classic antiquity, not only of Rome, but of those scattered over Italy and Sicily; besides a great number of the public edifices, churches, palaces, &c. that have been erected in Rome since the revival of the art. The plates of Piranesi are always taken from his own designs; they are drawn with great accuracy and truth; evince a profound knowledge of the principles of perspective; they are composed in the most agreeable and picturesque manner, and executed with a spirit, clearness, and depth of effect that has never been equalled. The style of Piranesi is extremely simple, consisting almost entirely of parallel lines, varied in their direction or character according to the perspective situation, form, or quality of surface of the several objects, adapting it with equal judgment and success to the corroded surfaces of ruined edifices, in every variety of circumstance, or to the polished smoothness of recent and uninjured masonry.

Piranesi was the first who, in his etching, made such abundant use of the ruler, with which the greater part of his effect is produced, and which he contrasted with the bold and more irregular touches of the point, and afterwards retouched with the graver, though he always kept this subordinate to the point. As in the subjects which he usually represented his chief aim was to give distinctness to the objects, he has not attended at all times to the concentration of his light, which he could not have done without compromising, in some measure, this quality. Many of his large plates have therefore a considerable spottiness; but in such subjects, where breadth of chiar' oscuro did not interfere with this, he shews great power and skill in the distribution of his light; at all times the effect on the separate parts is managed with much science; and the clearness of his shadows and reflex lights, while every part of them is kept in due subordination, is such as to give all the distinctness of day light, without infringing on the brilliancy of the lights. The plates of Piranesi amount to many hundreds, a great proportion of which are of imperial folio size; and although he lived to a good old age, it is utterly inconceivable, with all the assistance he could possibly receive, how he should have been able to produce so many, particularly when we reflect on the difficulty and minuteness of the subjects, and the truth and accuracy with which they are executed.

Francesco Piranesi, born in the year 1748, was son of the preceding artist; he engraved landscapes and ruins, and imitated the style of his father; he possessed considerable talents, but suffers much from comparison with him; he also engraved a number of plates from the antique statues in the style of Pitteri; they are well drawn and finely executed. Laura, daughter of the elder Piranesi, also engraved some plates of Roman ruins, in which she distinguished herself as an artist of taste and genius.

Joseph Wagner, a native of Thalendorf on the lake of Constance, was an eminent engraver, born in the year 1706; he first studied painting under Giacobo Amiconi at Venice, by whom he was persuaded to direct his attention to engraving. He travelled to Paris along with Amiconi, and during his stay there received some instructions from Laurence Cars, and visited England along with his friend. On his return to Venice he established himself as an engraver and print-seller, and there formed a school of engraving, in which several eminent artists began their career; his plates are executed in a clear, broad style, and are brought to a good effect with the point, and finished up afterwards with the graver.

Dominico Cunego, born at Verona in the year 1727, was an artist of considerable eminence; he has executed a number of plates after the great masters of the Italian school; his drawing is correct, and his plates are wrought up with great neatness; there is often, however, a considerable degree of hardness in his flesh, from being over wrought. Some of his best works are in the *Schola Italica*, published at Rome by Gavin Hamilton; he has also engraved several plates from the pictures of that master, and others, for Mr Boydell's collection.

Francesco Bartolozzi, born at Florence in the year 1730, received his first instructions in design from Fervetti, in that city, and afterwards entered the school of Wagner at Venice. His first productions were a series of plates after Marco Ricci, Zucarelli, &c. which he executed during his stay with Wagner; they are etched in a broad, clear, and transparent style, and touched up with the graver, and the figures are drawn with great taste; he has executed an amazing number of plates, and in every variety of manner. He drew the figure with wonderful skill and correctness, but, it must be confessed, frequently without conveying the true character of the original, particularly in the extremities; but his heads are expressed with great elegance and grace. Bartolozzi came to England in the year 1764, and did much to improve the arts of the country, which were then only emerging from the state of degradation and neglect in which they had long been sunk.

It is much to be regretted that, from the prevailing fashion of the time, so many of his plates should have been executed in stipple, or the chalk manner, when he possessed such amazing skill in handling the graver and etching needle; and that, from motives of private attachment and disinterested friendship, he sacrificed so much of his time and talents in engraving from pictures of very inferior merit. His plate of Clytie, a circular of folio dimensions, after Annibal Caracci, is sufficient evidence that he was capable of treading the highest walk of the art; it is an engraving in the stroke manner, executed with great delicacy and powerful effect, and exhibits in a strong light his mechanical skill and profound science. In his imitations of the drawings of great masters, he has given all the character, spirit, and fire of the originals; and in his small vignettes, opera tickets, and the like, he has added to correctness of design and infinite grace and elegance, the greatest beauty of execution and harmony of effect. All his works of this kind are much esteemed by the judicious collector; but his plates in the chalk manner, after Angelica Kauffman and others, are seldom admitted into the portfolios of connoisseurs. About the year 1809, Bartolozzi, having obtained a pension from the Prince Regent of Portugal, retired to Lisbon, where he died at a very advanced age.

Giovanni Volpato, born at Bassano in the Venetian territory, in the year 1738, was, according to some authors, a disciple of Bartolozzi while he resided at Venice; he afterwards settled at Rome, and became one of the most distinguished artists of that city. His best plates are generally taken from the pictures of Raffaelle in the Vatican, and are of considerable dimensions. They are well drawn, and executed with much ability; they are often, in the flesh, dry, hard, and heavy, and possess none of the delicacy and juiciness of Strange, and some of the other engravers of the French and Italian schools; his plates are very numerous.

Raffaelle Morghen, born at Naples in the year 1755, was son-in-law of Volpato, under whom he acquired great proficiency in the art. He is justly celebrated for several admirable works of very large dimensions, viz. The Last Supper, after Leonardo da Vinci; the Aurora, after Guido; and many others after the finest pictures of the great Italian masters.

There are many other engravers of the eighteenth century of respectable ability, but whom we must pass over, as we have already transgressed our limits; we shall, therefore, conclude our view of the Italian school with Schiavonetti.

Luigi Schiavonetti was born at Bassano, in the Venetian territory, in the year 1765. Having at a very early period of his life shewn a great disposition for the cultivation of the arts of design, he was received into the house of Giulio Golini, a painter of considerable talent at Bassano, under whom he acquired great proficiency in drawing, and continued with him till the death of his instructor, a period of about three years. He was next employed by some publishers at Venice, whence he found means to come to England, and resided for some time in the house of Bartolozzi, whose friendship and instruction he enjoyed. He drew the human figure with the greatest correctness and science, and he handled the graver with freedom and delicacy. Unfortunately for his fame, the greater part of the time he lived in England, the chalk manner was almost the only style of engraving that received encouragement, and the world has thus been deprived of the benefit of his talents and industry, in a department of art which he was well qualified to adorn. Among the few plates he has executed in the line manner, the "*Madre Dolorosa*," or Dead Christ on the lap of the Virgin, after Vandyke, a work in small folio, deserves our particular notice. It unites every quality that we would wish to see combined in such a subject. The drawing is correct and vigorous, and exhibits profound anatomical knowledge; the expression of the countenance is powerful, the carnations are delicate and fleshy, and, by the judicious combination of the point and graver, and adapting the style of each part to its peculiar character, he has produced a work of art, which, as an assemblage of so many excellencies, has never been surpassed. His etchings are masterly, and full of fine feeling and correct design. His chief works in this way are, the plates of Blair's "Grave," designed by Blake; and the etching of Chaucer's Pilgrims, after Stodart. This plate was to have been finished by Schiavonetti, but he died before it was completed. A few impressions were taken from it in the state in which he left it, and it has now been finished by Mr Bromley. His chalk engravings are very numerous; several of them will be found in Boydell's Shakespeare, and are, in general, taken from the pictures of the masters of the English school.

Sect. IV. *Of the French School.*

The art of engraving was introduced into France from Germany towards the end of the fifteenth century, and was for a long time chiefly employed in the decoration of books; the wood cuts, in point of time, preceding the copperplate engraving a few years. The names of those who first practised in France are not known; but it is highly probable that they were Germans. The most ancient book containing wood cuts, published in France, is the translation of *Speculum Humanæ Salvationis*, printed at Lyons in the year 1478; and the next is the translation of Belial, printed in the year 1482, as its concluding paragraph informs us. It runs thus: "Here endeth the book called Consolation for Poor Sinners, lately translated into French by the venerable and discreet brother Peter Forget, doctor of theology, and of the order of the Augustines. In the year of Grace 1482, and on the 21st January, he finished this book."

The first French book containing copperplate engravings was a work of Nicolas le Huin, a monk of mount Carmel, and professor of theology. It is said to be only a compilation of the Itinerary of Bernard de Breydenbach, and is intitled "A Peregrination beyond Sea to the Holy Land; of the holy peregrinations to Jerusalem, the environs and places adjacent; of Mount Sinai and the glorious Catherine;" and concludes with the following words: "This work and little book *(cet ouvraige et petit livre)* containing the description of the whole, as far as God has permitted to be known, printed at Lyons by honest men, *(honnestes hommes,)* Michelet topie de Pymont, and James Herenberg of Germany, residing at

Lyons, the year of our Lord 1488, and the twenty-eighth of November." The plates of this work are copied from the wood cuts of the Itinerary of Breydenbach, published at Mentz, in the year 1486, by Erhard Rewich. These plates consist of views of towns, and present little deviation from the originals, except the addition of vessels and other accessaries; the execution is sufficiently neat, but hard and stiff, and the design is more barbarous and incorrect than the originals.

Many other plates of different kinds were executed before the close of the fifteenth century; but being in the most barbarous style, and as they have neither name nor monogram attached to them, they do not merit any particular attention.

Wendel Reich is the first engraver whose name has been preserved. He is supposed to have been a German; he lived at Lyons in the year 1515: his prints are only wood cuts.

Jean Duvet, or Danet, born at Langres in 1510, engraved many plates on copper, from sacred and mythological subjects; the designs and the style of execution are equally wretched. He is sometimes called, from the cypher he used, *le maitre au licorne*,—the master of the unicorn.

Solomon Bernard, called sometimes by the French writers *le Petit Bernard*, from the small size of his works, was born at Lyons in the year 1512, and was chiefly employed by the booksellers of that city. He is said to have been a disciple of Jean Cousin, a painter of great genius and taste, who is considered the founder of the French school of historical painting. He engraved both on copper and on wood, and his works display very great improvement in the style of art, both as to design and execution, evincing considerable fertility of fancy, and, being neat and clear, shew much mechanical skill in handling the graver.

Stephen de Laulne, born at Orleans in the year 1520, is the next engraver mentioned. It is supposed that he studied at Strasburgh, but it is not known under whom. He was a man of considerable fecundity of imagination; his designs are often well conceived; but his drawing of the human figure, and the effect of the chiar' oscuro, are very defective. The greater number of his prints are after his own designs; but he has also made several copies after Marc Antonio, which are excellent, and highly esteemed. His plates are executed entirely with the graver.

Noel Garnier, born about the year 1520, has been often, though erroneously, said to have introduced the art into France. He was originally a goldsmith; and from the Gothic style of his plates, it is probable he had learned what he knew of the art from some German goldsmith. They are exceedingly rude and badly executed; they consist of 48 plates of arts, sciences, and trades, and an alphabet of capital letters, ornamented with figures and foliage. Strutt also mentions a small plate of a battle between several naked men, in which he seems to have made a feeble attempt to imitate Sebald Beham. Heinecken mentions another plate of Garnier, copied from Albert Durer.

Peter Woeiriot, born at Bar le Duc, in Lorraine, in the year 1525, was a goldsmith and an engraver on wood and copper: his works are in general from his own design, and, considering the very low state of the arts in France in his time, are very well executed.

Jacques Perisin, born about the year 1530, engraved on wood and copper, and appears to have been the first of this school who practised etching. His etchings are in a coarse and incorrect style; but his wood cuts are sufficiently neat, and the cross hatchings are well executed.

René Boivin, a contemporary of Perisin, executed a considerable number of plates on wood and copper. Some of his copperplates are executed entirely with the graver, having some resemblance to those of Cornelius Cort. He also practised etching. His plates are not deficient in mechanical beauties, as he handled the graver with great facility, but his drawing is defective, particularly in the extremities.

Philip Thomassin, born at Troyes in Champagne in 1536, is supposed to have wrought at first for the goldsmiths. He went to Rome early in life, and became a pupil of Cornelius Cort, and afterwards of Cherubino Alberti. He has engraved a great many plates after the Italian masters. He resided at Rome till his death. His plates are executed, in a slight but clear style, entirely with the graver; they are not, however, remarkable for delicacy of effect or fine drawing.

Leonard Gaultier and Melchior Tavernier also flourished about this time; neither of these is entitled to much attention. The latter was the first engraver in France who bore the title of engraver to the king.

Thomas de Leu, born at Paris about the year 1570; he engraved several historical works after his own designs; but his most interesting prints are the portraits he executed of the nobility and other distinguished characters of France of that time. His plates are executed with great neatness, and entirely with the graver.

Louis Businck, about the end of the 16th century, engraved in chiar' oscuro; his cuts have a fine broad effect, and are executed in a very masterly manner.

François Perrier, born in Burgundy, in the year 1590. He studied at Rome. His works consist chiefly of etchings of antique statues and basso-relievos; they are not well drawn, and the heads and extremities are quite neglected, and thus give but a very imperfect idea of the character of the originals; they are, however, etched with sufficient freedom, and, notwithstanding their slightness, are interesting memorials (more especially the basso-relievos) of those exquisite remains of ancient art.

Stephen Baudet, born at Blois in the 1598, having received his first instructions in the art at Paris, went to Italy for improvement. It has been said, that at different periods of his life he adopted two different styles of engraving; that his first works are neat, but bold and mechanical, and executed entirely with the graver; and that on his return to Italy he greatly improved his style by the use of the point, with which he advanced his plates a great way, and finished them with the graver. With great submission to the respectable authority of Mr Strutt, who states this, it does not appear from any of the specimens of Baudet (and some of them of his best time) now before us, that he made use of the point; and, in particular, the eight large landscapes after Nicolo Poussin, published in 1684, cited as an example of this, have all the appearance of having been done entirely with the graver, though certainly, if he had been accustomed to the management of the point, the effect would have been greatly improved by the use of it. The plates of Baudet are generally taken from the pictures of Poussin and other great masters of the Italian school. He drew the picture with great correctness, and his prints have a fine rich effect. He also occasionally engraved in the style of Claude Mellan, an artist whom we shall presently take notice of. Baudet is the first of that brilliant constellation of engravers who adorned France during the 17th century, and who brought the mechanical part of the art of engraving to a state of great perfection, and which shed its influence over the whole of Europe.

Claude Mellan, born at Abbeville in 1601, went to Rome, and studied design under Simon Vouet, who was then president of the Roman academy of St Luke. He at first engraved in the usual manner, by producing his effect with cross-hatching; but he afterwards adopted a very singular style, which has hardly been followed by any other engraver except Pitteri, and the younger Piranesi in his antique statues, wherein the effect was produced by single lines. This peculiarity of style seems to have been adopted from whim and the love of novelty, as it possesses no advantage over the common method; and although his plates have a very agreeable effect, they sufficiently prove the incompetency of that manner to represent the various qualities of surface and texture, and depth and richness of effect, so essential to a perfect engraving. He has executed a great number of plates, chiefly historical subjects, from his own designs; but the most singular, as exhibiting his manner in its most extravagant form, is what is called the Holy handkerchief, or Sudarium of St Veronica; according to the legend, Veronica, in compassion to our Saviour, when sweating under the burden of the cross on his way to mount Calvary, gave him her handkerchief to wipe his face, and which ever afterwards retained the impression of the divine countenance. This he has executed with a single spiral line, beginning at the point of the nose, and extending itself over the whole surface of the plate, and the parts are made out by strengthening the line according to the depth of shadow required. His drawing is correct, but his plates are, from the causes which we have just mentioned, deficient in richness and variety of effect.

The style of Mellan was imitated by his disciple Jean Lenfant, born at Abbeville in the year 1615; but his plates are greatly inferior to those of his preceptor.

Israel Silvestre, born at Nancy in the year 1621, was the nephew and pupil of Israel Henriet. His works are numerous, and consist chiefly of landscapes and topographical subjects of a small size. He seems to have derived his style from Callot and Della Bella. His plates are for the most part etched, and display a fine taste in composition and design. His figures are spiritedly drawn, and finely introduced, and his mode of execution evinces a fine feeling and sound judgment.

Gabriel Perelle, born at Paris in the year 1622, was also an engraver of landscape; he wrought in conjunction with his two sons, Adam and Nicolas. Their plates are very numerous; they are chiefly from their own designs, and display a fertile imagination and a fine taste. Although there is not much of the fine detail of nature, their plates are well composed; the architecture with which they are adorned is well introduced and correctly drawn; the effect of the chiar' oscuro is, however, not well managed, and often very spotty; and from too profuse a use of the graver, there is often a want of the lightness, delicacy, and clearness, so conspicuous in the works of Callot and Silvestre. As the works of these three artists are not distinguished from each other by any particular mark or monogram, we cannot discriminate their respective works; they present, however, to the critical observer, two very different styles; in the one there is much softness and delicacy, and the lights being tinted, there is more breadth and harmony of effect, and the trees are better finished and have more variety of character; in the other, which is found by far the most frequently in their works, those defects occur which we have described above as their general characteristic. The plates in the best style are generally attributed to the father. We recollect of having seen two engravings by Perelle, which were executed in a style so much superior to any others we have seen, that we hold ourselves bound to mention them particularly. They were of a large 4to size; were finely composed; the trees were conceived and executed with infinite beauty and variety of character; and in harmony of effect, and delicacy of finishing, they are hardly surpassed by the finest engravings of that size that we have seen.

Jean le Pautre, or le Pôtre, born at Paris in the 1617, was originally placed under a goldsmith, with whom he learnt the elements of design, and particularly of ornamental composition. He seems also to have been well versed in architecture. His plates consist chiefly of designs for friezes and other ornaments, garden-scenes, and architectural subjects, containing also some story from ancient history. Although such subjects do not entitle an artist to hold the first rank, the works of Le Pautre certainly stamp him a man of genius; he designed correctly; his compositions display a most exuberant imagination; but his ornament and architecture, though drawn with firmness and precision, are loaded and heavy, and, being conceived according to the taste of his age and country, have none of the purity and simplicity of the antique examples of this department of art. His plates amount to upwards of fifteen hundred.

François de Poilly, born at Abbeville, in the year 1622, was the son of a goldsmith, under whom he acquired the first rudiments of the art of design and of engraving. He afterwards went to Paris, and was placed under the tuition of F. Daret, from whence he travelled to Rome, where he resided many years, and engraved a number of plates after the best masters of the Italian school. On his return to Paris he continued to practise the art with the greatest success, and formed a school of engraving which has produced many of the most distinguished artists of that time. The plates of de Poilly are executed entirely with the graver, in a style of handling which had not been equalled by any artist of his time. His drawing is correct and scientific; the airs of his heads are faithfully copied from the originals, and the extremities of his figures are finely marked; the style of his engraving is bold and clear, but there is not sufficient variety of character in the textures and surfaces of his objects, and the square crossings of his lines give a heaviness and hardness, particularly to his flesh, which is very injurious to their effect. The works of de Poilly are very numerous, and consist of historical subjects and portraits, which are highly esteemed.

Nicolas de Poilly, the brother and pupil of the preceding artist, was also an engraver. He imitated the style of his brother with great success, and, tho' he did not equal him, he holds a high rank in the art, and his plates are much and justly esteemed; they also consist of history and portraits.

Jean Baptiste de Poilly, son of Nicolas, is also a distinguished engraver; his plates have more delicacy and variety than those of his father and uncle, as he advanced them considerably with etching, and finished them with the point. Besides the instruction he received under these relatives, he resided several years at Rome, where he greatly improved himself.

Robert Nanteuil was born at Rheims in the year 1630. He is one of the greatest engravers which France or any other country has produced. Living at a time when the arts were greatly cultivated and encouraged, his genius did not languish for want of powerful excitement to exertion. The character of Nanteuil has been ably drawn by a contemporary writer, whose words we shall transcribe: "He drew correctly; even his slightest prints manifest the hand and mind of a master; and, in his more highly finished works, the perfect keeping of his heads, as they appear in the fine impressions, is admirable. His style of engraving he appears to have varied on principle, at different periods of his life, at first probably as his feelings, and afterwards as his judgment directed. Nanteuil first explored the unknown practicabilities of this department of art, and invented modes of combining lines with stippling, so as to express the firm softness of flesh, whether in light, shade, or middle tint; hair, in all its lightness of form, its native gloss, and its variety of flow and colour; ermine he also taught his succesors to characterise, and the peculiar textures of the various articles of dress. The engravers who will compare Nanteuil's works with one another, may trace in them what may be called a course of the experimental philosophy of portrait-painting, over which genius presided. He appears at first, like Mellan, to have employed single courses of lines, as may be seen in his portrait of Louis Hesselin; in the flesh of Christina, queen of Sweden, he employed stippling alone; while in that of the president Mole, he employed only unbroken lines. It would appear that he was now analysing his art, and measuring his own powers against its difficulties, and that in his subsequent works he combined the elements which he now ascertained of soft, firm, clear, rich, mellow, and characteristic surface, as occasion admitted or required. His most frequent and most admired practice was to stipple the lights and half-tints of his faces, and employ cross-hatchings sometimes with *interwork* for the shadows, insensibly blending his carnation tints, (as a painter would say,) except where abruptness was demanded by the subject; and over all, unswayed by the ornamental tendency, in that luxurious age, of the art of his country, he threw the ineffable charm of simplicity." His plates amount to the number of about 300, which was truly astonishing when we consider the shortness of his life, (for he died aged 48,) the care and labour bestowed on them, and the time he employed in painting portraits, from which a great many of his plates are taken.

Nicholas Regnesson, born at Rheims in the year 1625, was the brother-in-law of Nanteuil, whose disciple, according to Strutt, he was, and to whose style his works bear a strong resemblance, though they do not equal them. They consist of book-plates, and portraits from his own designs, and historical subjects after S. Bourdon, Le Brun, N. Coypel, &c.

The style of Nanteuil was also imitated, with tolerable success, by Jean Frosne, born in the year 1630. He executed a considerable number of portraits, which, though greatly inferior to those of Nanteuil, are much esteemed.

The family of the Corneilles have left a considerable number of etchings of great merit; Michel Corneille, the elder, born 1603, was a disciple of Simon Vouet; he was one of the twelve original members of the Royal academy of Paris. He has left several etchings after Raffaelle, the Caracci, and others.

Michel Corneille, the younger, born 1642, was a painter of considerable reputation, and has left a great number of etchings after the Caracci and other Italian masters, and from his own designs, which are much esteemed.

John Baptiste Corneille, brother of the preceding artist, has also etched many subjects from the Italian masters and from his own designs; they are executed with spirit, and finished with the graver.

The family of Audran at this time make a very distinguished figure in the art.

Charles Audran, born at Paris in the year 1594, is the first person of this name. Having learnt the first elements of the art at Paris, he went to Rome, and engraved some plates with considerable success; he seems to have imitated the style of Cornelius Bloemart, executing his plates entirely with the graver. He settled at Paris, and died in 1674. His early plates are marked with a C.; but when his brother Claude, whom we shall next take notice of, began to engrave, he made use of the letter K, being the initial letter of Karl, for the sake of distinction.

Claude Audran, born at Paris in the year 1592, began to engrave at a late period of his life. His works, which are not numerous, are of inferior merit.

Germain Audran, son of Claude, was born at Lyons in the year 1631. He received the first rudiments of the art from his father, and subsequently prosecuted his studies at Paris under his uncle Karl, or Charles, whom we have mentioned above. Though inferior to several of the rest of his family, his talents were respectable; he has left a few portraits and a considerable number of plates of ornaments, ceilings, vases, &c. He resided chiefly at Lyons, where he died in 1710.

Claude Audran, the second of that name is mentioned as an engraver and a man of talents; none of his plates have been particularized, and they do not seem to be well known. He was born in the year 1639, and died in 1684.

Gerard Audran, born at Lyons in 1640, was the son of the first Claude whom we have already mentioned. He is the most distinguished of his family, and one of the greatest engravers that France or any other country has produced. He learnt the first principles of design from his father, and was sent to Paris to receive the benefit of his uncle Charles's instruction; he next went to Rome, where he is said to have become a disciple of Carlo Maratti. During a residence of three years in that capital, he engraved several plates, which raised his reputation so high as to induce Colbert to invite him to Paris, whither he returned, and was immediately appointed engraver to the king, with a considerable pension and apartments in the Gobelins. He drew the figure with great correctness and spirit, and in his execution he improved greatly the mode of uniting the point and the graver, and brought it to a perfection that has hardly been equalled since. He has engraved a great number of historical subjects after the great Italian and French masters, and many portraits; his plates are ranked amongst the choicest productions of the art, and stamp him one of the most accomplished and assiduous artists who have ever lived. His plates are extremely numerous, and many of them very large; but his most celebrated work is the four plates of the battles of Alexander the Great, after Le Brun; and from the astonishing number of figures they contain, they are certainly the most laborious as well as the largest prints ever engraved; each consists of four plates, and they are usually pasted together.

Benoist Audran, the second son of Germain Audran before mentioned, was born at Lyons in the year 1661; he received his first instructions in design and engraving from his father, and afterwards studied under his uncle Gerard. Although he never equalled Gerard, he holds a high rank as an engraver; his drawing is correct, and the air and expression of his countenances are finely marked; his plates, like those of the rest of his family, consist of historical subjects and portraits; they are very numerous, and highly prized by the judicious collector.

John Louis Audran, brother of Benoist, also inherited the taste and talents of the family. John executed a great number of plates, historical subjects and portraits, in an excellent style: Louis was chiefly engaged in carrying on the works of his brothers; he has also left a few plates of his own.

Stephen, or Etienne Picart, was born at Paris in the year 1631: He studied at Rome, and on his return to Paris he assumed the surname of *the Roman*. He was engaged with other celebrated artists in engraving the pictures in the King of France's collection. His drawing is not very correct, and there is often a want of harmony in the effect of his plates; they bear sometimes a considerable resemblance to those of Poilly, being executed entirely with the graver; sometimes they possess more lightness and delicacy, by being brought to a considerable forwardness with the point. His plates consist of historical subjects, after the Italian and French masters, and also of portraits.

There also flourished at Paris, about the middle of the seventeenth century, John Picart, supposed to have been a relative of the preceding artist. He was an artist of little note, and seems to have been chiefly engaged in executing book-prints; and we introduce his name here rather to distinguish him from the other two artists, his synonymes and contemporaries.

Bernard Picart, the son of Stephen mentioned above, was born at Paris in the year 1663. He was instructed in design and engraving by his father; he was perfect master of drawing, and had an amazing fertility of invention, and a fine taste in design. His plates consist chiefly of book-cuts, and other ornamental engravings, usually taken from his own designs. He engraved commonly in a small size, combining, with great judgment, the operation of the point and the graver; In his larger plates, notwithstanding the correctness of his drawing, he was not so successful. In 1710 he left Paris, and settled at Amsterdam, where he was much employed by the booksellers. He also engraved a set of seventy-eight plates, in imitation of the different styles of the old engravers, which were published after his death, under the title of *Les Impostures Innocentes*; he also scraped a few mezzotinto prints.

Gerard Edelinck, born at Antwerp in the year 1627, was originally a disciple of Cornelius Galle, under whom he attained such excellence, and so high a reputation, that he was invited to Paris by Colbert, where he was taken into the service of the king of France, who settled a pension on him, and assigned him apartments in the Gobelins; he was afterwards received into the academy, and knighted. Edelinck understood the human figure well, but he did not draw it with the taste and correctness of Gerard Audran; he was particularly successful in giving a fine air and expression to his heads. The effect of the chiar' oscuro is admirably managed, and he had a thorough knowledge of the art of expressing local colour; his execution unites neatness with freedom and boldness. His plates are executed entirely with the graver, of which he had wonderful command, as the great beauty, the number, and (in many instances) the magnitude of his works sufficiently prove. His plates consist of historical subjects after the great Italian and French masters, among which is the Tent of Darious, a very fine plate on two sheets, which forms part of the set of Alexander's battles, the rest of which were executed by Gerard Audran; he has also left a great number of portraits which are much esteemed.

Sir Nicholas Dorigny, born at Paris in the year 1657, was the son of Michael Dorigny, an artist of no great reputation, who was pupil and son-in-law of Simon Vouet. Nicholas was originally destined for the bar, at which he practised till he was thirty years

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of age, when, directing his attention to the arts, he visited Italy, where he remained twenty-eight years; he first attempted painting, but afterwards devoted himself almost exclusively to engraving. His first plates were entirely etched, but in his latter works he improved his style, by adopting as his model the manner of Gerard Audran, and uniting the operation of the point and the graver. Although he does not approach the excellence of that celebrated artist, either in his scientific drawing, the power of his chiar' oscuro, or the delicacy and force of his execution, his plates are esteemed as highly respectable productions of the art, and acquire additional value from the celebrity of the subjects he chose. His plates are in general taken from the most esteemed productions of the Italian school, such as the tranfiguration and cartoons of Raffaelle, the taking down from the Cross of Daniele da Volterra, &c. He visited England, where he engraved the cartoons, and also painted a few portraits with indifferent success; he was knighted by King George the First.

Louis, the elder brother of Dorigny, was a respectable painter in fresco and in oil; he resided chiefly at Verona, where he also executed a few etchings.

Peter Drevet, the elder, born at Lyons in the year 1664, was originally a disciple of Germain Audran, under whom he learnt both drawing and engraving, and is supposed to have afterwards become a pupil of Edelinck. He confined himself chiefly to portraits, in which he deservedly acquired a very high reputation, which time has rather increased than diminished. He had wonderful facility in handling the graver, with which his plates seem to be entirely wrought; his style is firm, but extremely delicate, and very highly finished; he drew well, and he conveyed with great truth and force of expression the character of the originals. There are only two historical subjects, viz. the Crucifixion, in two sheets, and Christ's entrance into Jerusalem; the rest are portraits, and are highly esteemed.

Peter Drevet, the younger, born at Paris in the year 1697, was the son of the preceding artist, whom he surpassed, and of whom it has been said, that he might have been regarded as the first engraver of portraits in the world for delicate and beautiful execution, had he not in this respect been surpassed by his son. The younger Drevet executed a considerable number of historical subjects, which, though engraved with infinite beauty and delicacy, are not so highly esteemed, as his style was not so well adapted to the generalized grandeur of historical composition; but his portraits rank among the finest productions of the graver, and his two plates of Samuel Bernard, and Bossuet, both after Rigaud, are justly celebrated throughout Europe as master-pieces of the art.

The family of le Sueur now require our consideration; they chiefly devoted themselves to engraving on wood, in which they displayed much ability.

Peter le Sueur, the elder, born at Rouen in the year 1636, was instructed by an obscure artist of the name of du Bellay, whom he greatly surpassed.

Peter le Sueur, the younger, was instructed in the art by his father; he was born at Rouen in the year 1663. He drew with tolerable correctness, and executed his cuts with great delicacy.

Vincent le Sueur, born at Rouen in 1668, was the younger brother of the preceding. He was first a disciple of his father, and afterwards went to Paris, and was instructed by John Papillon; his cuts, though not well drawn, are highly esteemed. He also executed several prints in chiar' oscuro.

Nicolas le Sueur, son of Peter le Sueur, the younger, was born at Paris in the year 1690. He is a distinguished engraver on wood, and was the most eminent of the whole family. He engraved several blocks in chiar' oscuro for the Crozat collection, which gained him great reputation, and the ornaments which embellish an edition of Fontaine's fables, which he executed in a very tasteful style from the designs of Bachelien.

The family of Papillon, as having contributed in some measure to adorn the art, demand our attention in this place.

John Papillon, the elder, flourished at Rouen in Normandy about the year 1670. He never arrived at any celebrity, and is only mentioned in this place for the merits of his family.

John Papillon, the younger, son of the preceding artist, was born at St Quintin in the year 1661. He was first instructed by his father, and afterwards was placed under the care of Noel Cochin at Paris. He was also an engraver on wood, in which he shewed considerable talents; his works consist chiefly of vignettes and book ornaments, but he is also said to have been the inventor of stamping paper in imitation of tapestry, an art which has in latter times been brought to great perfection, and which has contributed greatly to the comfort and elegance of our modern habitations. But the most distinguished artist of this family is

John Baptiste Michel Papillon, son of the last-mentioned artist, born at Paris in 1698, like the rest of his family, devoted himself entirely to engraving on wood, which he cultivated with great success. He was engaged, along with M. le Sueur, in executing from the designs of Bachelien, the decorations for the splendid folio edition of la Fontaine's fables; the plates which he has engraved for this work are amongst his best works. He is also celebrated for his well-known work, the "Traité historique et pratique de la Gravure en bois;" a book which, from the circumstances under which it is written, being the first complete treatise on the subject, is by no means correct; it is, however, highly favourable to his reputation as a man of industry and research, while the numerous plates which he has introduced give a very favourable specimen of his talents and taste as an artist.

Gaspar Duchange, born at Paris in the year 1662, is one of those who may be ranked among the greatest engravers of this school. It is not known under whom he studied, but it has been supposed that he derived the elements of his style from John Audran. In his plates he combined, with great judgment and taste, the graver and point, and gave his works great delicacy and power of effect; he is particularly celebrated for the admirable manner in which he executed the flesh of his females. His great excellence in this respect is sufficiently exemplified in his celebrated plates after Coreggio, into which, with a most felicitous feeling, he infused the grace and delicacy of that charming painter.

Francis Spierre, born at Nancy in the year 1643. He first studied at Paris in the school of de Poilly, whom he in a short time excelled. He travelled to Italy, where he executed his best works. His style is various, sometimes soft and delicate, sometimes powerful and bold, and, though he wrought only with the graver, he often surprises with a playfulness and spirit like etching; he has also executed a few plates in single courses of lines like Mellan, in which he has shewn the utmost dexterity in the handling of his graver. He died at the early age of thirty-three.

Jean Louis Roullet, born at Arles in Provence in the year 1643, was first a pupil of Lenfant, and perfected himself under de Poilly, whose manner he adopted; he also studied in Italy, where he resided ten years. His drawing is correct and scientific; he was an excellent master of expression; the effect of his chiar' oscuro is powerful and broad, and his management of the graver displays great mechanical skill and ability. Like the other artists of his time, he devoted himself to history and portrait.

Sebastian le Clerc, born at Metz in the year 1637, received his first instructions in design from his father, an eminent goldsmith in that city. It appears that he was originally destined for an architect and engineer, and was accordingly well instructed in the mathematics. On his coming to Paris, he was persuaded by Le Brun, to whom he had been introduced, to dedicate his talents to engraving. The versatility of his talents is only equalled by the industry and success wherewith he exerted them. Besides his historical subjects and portraits of a larger size, he executed an incredible number of small pieces, of temporary interest, such as processions, triumphs, &c. as well as architectural subjects, landscapes, perspectives, and medals. His small figures are drawn and introduced with much correctness, taste, and spirit; his draperies are simple and finely cast; the expression of his heads is noble and characteristic, and the accessories of his compositions are conceived and executed with great taste. He generally advanced his plates with the point to a state which left little for the graver, except to give harmony and force of effect; and if his execution is inferior to Della Bella in the playful charm of the point, it possesses a judicious firmness suited to the higher subjects he has engraved. The number of his plates amounts to nearly three thousand.

Charles Nicholas Cochin, born at Paris in the year 1688, was an engraver of great eminence; he studied painting till he was nineteen years of age, and then devoted himself entirely to engraving; he drew correctly and engraved with taste and spirit; his plates consist of historical subjects and portraits.

Charles Nicholas Cochin, the younger, son of the preceding artist, was born at Paris in the year 1715; he was instructed by his father, and was an eminent designer and engraver. His plates, besides historical subjects and portraits of a larger size, consist also of frontispieces, vignettes, and book cuts, chiefly from his own designs, which are conceived and executed with judgment and taste. They amount in number to fifteen hundred.

Charles Dupuis, born at Paris in the year 1685, was a pupil of Duchange; he engraved many portraits and historical works, which he etched with taste, and finished with the graver in a free and masterly manner; his drawing is correct, and his heads are full of expression and character.

Count Caylus, born at Paris in the year 1692. This nobleman dedicated his whole attention to the art, and has etched an immense number of plates in imitation of the original sketches and drawings of the great masters. They display more industry than talent, but are esteemed as being faithful copies of the originals; his plates, which are very numerous, were often finished by professional engravers, such as Fessard and Le Bas. His most celebrated work is "Recueil d' Antiquités Egyptiennes, Etrusques, Greques, Romaines, et Gauloises, published in seven volumes folio.

Raymond la Fage, born at Thoulouse in the year 1648, was a designer of great eminence; his sketches were only outlines in pen and ink; he had a fertile imagination; his drawing is correct, and unites elegance and grace with freedom of action; he etched many of his own designs in the style of the originals, and others have been very successfully imitated by several other eminent engravers of the French school.

John du Vivier, born at Liege in the year 1687, was an engraver of respectability. He wrought in a neat clear style; but he chiefly excelled in engraving dies for medals, and was, in the year 1735, appointed medalist to Louis XV.

Besides the artists which we have now mentioned, there flourished, towards the end of the 17th century, which was the golden age of French engraving, a great number of engravers of talent, such as Scotin, Simmoneau, the Larmessins, Châtillon, Blondel, Duflos, Grignon, De la Haye, &c.; but as we have already extended this part of our article considerably beyond the limits we originally assigned to ourselves, we shall conclude our account of the French school by selecting a few of the most distinguished engravers of the 18th century.

Laurence Cars, born at Lyons in 1702, was the son and scholar of Jean François Cars, an engraver of little celebrity in that city; he engraved history and portrait, and is reckoned one of the greatest artists of the 18th century. By engraving much from the pictures of Le Moine, he contracted a manner of giving great delicacy and a fascinating mellowness, which, though well adapted for the imitation of such works, was not equally suitable for the powerful style of the Italian school. His works are generally of a large size, and are very numerous.

John Daullé, born at Abbeville in the year 1703, was an engraver of great eminence. He received his first instructions in the art from Robert Hecquet, an obscure artist of his native city. He improved his taste on going to Paris; and his merits in a short time introduced him to notice, and obtained his election to the academy. He engraved history and portraits in a clear neat style, but he is best known in this country by his portrait of the young

Pretender, which appearing with his titles as prince of Wales, &c. was prohibited by the British government; the impressions commonly met with have no name, but the others are most valuable, and sell at very high prices.

Jaques Philipe le Bas, born at Paris in the year 1708, was a disciple of Tardieu; his works consist chiefly of engravings from the landscapes, cattle-pieces, and conversations of the Dutch masters Berghem, Wovermans, Teniers, Ostade, Du Jardin, &c. His drawing is spirited and correct, and he produced an admirable effect of lightness and delicacy, united to great spirit and force. His plates are advanced to a state of considerable finish by the point, and re-touched to their proper strength with the graver; his plates are extremely numerous, but very unequal, as he employed his numerous pupils in executing different parts of them, many of which, though marked with his name, he perhaps hardly touched.

Jean Jaques Balechou, was born at Arlos in the year 1715, was an engraver who carried the management of the burin to still greater perfection than had been done by even the greatest masters of the French school. His plates possess infinite neatness and clearness of stroke, and amazing brilliancy of colour; but his drawing is very defective, and his flesh is hard and metallic. In his historical works, such as St Genevieve, he was not so successful; they display less of the just feeling of the painter, less discrimination, and every where too much labour and attention to the mechanical execution, and at the same time neglect of the sentiment which the dignified character of historical composition ought always to inspire; and even some of his portraits display the same defects. But the three landscapes after Vernet are amongst the finest productions of the graver; and although, even in them, the hardness which we have ascribed to his other works frequently occurs, they are works of exquisite beauty, and are undoubtedly the source whence Woollett derived his fine style of engraving.

John George Wille, a native of Konigsberg, was born in the year 1717. He carried the beauties of mechanical execution infinitely beyond all that had ever been attempted before; he stands unrivalled for the clearness of his cutting and the beauty and smoothness of his effect. He was singularly successful in the representation of satins, silks, carpets, tissues, and, in short, the various textures of all sorts of stuffs; but from the regularity and unbroken character of his lines he has communicated to his flesh more the appearance of marble or bronze than the softness and pliability so peculiarly required. His large plate of the death of Marc Antony, after G. Netscher, wherein Cleopatra is represented with a a white satin dress, exhibits in a very strong light all his beauties and defects. He has engraved in the same style a great number of plates after Miris, G. Douwe, Metzu, Schalken, Netscher, and others. He also engraved many portraits, which are very fine. He had many pupils who imitated his style with considerable success.

George Frederick Schmidt, born at Berlin in the year 1712, was instructed in design and engraving by G. P. Busch, an obscure artist of that city; but he came to Paris and studied under Nicholas Lamessin, under whom he acquired a style of admirable neatness and firmness. He was received into the academy in 1742; he afterwards went to St Petersburg, by the invitation of the empress Elizabeth, where he engraved several prints with great success; he also executed a number of etchings in the style of Rembrandt, wherein he has given a great richness and variety of character, a fine breadth of chiar' oscuro and power of local colour.

Antony Ghuy de Marcenay was an artist who flourished about the middle of the eighteenth century; he is best known by his etchings in the style of Rembrandt, in which he was singularly successful; his plates are numerous, and are reckoned amongst the best imitations of that great master.

The Abbe de St Non, born at Paris in the year 1730, was a distinguished amateur; he etched several plates of landscapes; but he is chiefly celebrated for having invented the art of aquatinta engraving, in which manner he executed several plates. He communicated the discovery to le Prince of Paris, who gave the new art great celebrity by the very spirited specimens which he engraved in that manner, and which was in a short time very generally practised.

During the eighteenth century the French School has produced a great number of respectable artists, whom our limits will not permit us to mention; but as they have thrown no new light on the art, and have, except in the instances which we have mentioned, in no way reached the excellence of the great masters of the preceding century, and having also devoted themselves more to the frivolous taste of the time than to the grand style of the better ages of the art, their works are less worthy of our attention.

The French engravers of the present day still maintain the reputation of their country for the beauties of mechanical skill; but from the coldness and insipidity of their school of painting, their works have been little relished out of France.

Sect. V. *Of the English School.*

Engraving, like the other branches of the fine arts, was in England of slow growth, and has only attained to maturity since the accession of his present Majesty to the throne.

Engraving on wood was introduced into England about the same time as the art of printing, and was then employed in the decoration of books, and shortly afterwards copperplates were also used for the same purpose. The first English artist whose name has been preserved is Thomas Gemenie or Geminus, a printer and engraver, who published, in the year 1545, an edition of Vesalius's Anatomy, which had been first published at Padua in the year 1542, illustrated with large folio wood-cuts; these were copied on copper, and the work was dedicated to Henry the Eighth. He also published several other books ornamented with copperplates, some of which were dedicated to Edward the Sixth and queen Elizabeth. The works of the native English engravers of this time are wretched in point of execution, and unworthy of any particular notice; they consist of maps, portraits, and views of towns, title-pages, and coats-of-arms: but those who desire a more minute view of this subject, will find more copious information in "Walpole's Anecdotes." The art was, however, cultivated with greater success by foreigners, who occasionally visited England, and were chiefly employed in portrait-engraving. The most distinguished amongst these are, Theodore de Brie, Crispin, William, and Simon de Passe, and Judocus, and Henry Hondius.

John Payne is the first Englishman who distinguished himself as an engraver. He was born about the year 1610, and was a disciple of Simon de Passe. He was a man of great genius, and his plates, executed in a free, open style, with more force than those of his master, have a very pleasing effect. His portraits are much esteemed; but he has also left many frontispieces, landscapes, animals, and flowers, of great merit. He engraved likewise, on two plates, a print of a ship called the Royal Sovereign, built in the year 1637. The two pieces, when joined, form a print three feet long, by two feet two inches high. If his industry and application had been equal to his genius, his name would have stood much higher amongst the artists of his country; but, leading an irregular and dissipated life, he died in indigence before he reached the 40th year of his age.

Lucas Vosterman, whom we have already mentioned in another place, resided in England about the year 1630, and engraved a great number of portraits after Vandyke, Holbein, &c. and was particularly patronized by King Charles I. and the earl of Arundel. At this time, also, Robert de Voerst, a native of Arnheim, resided in England. He is mentioned in King Charles's catalogue as engraver to the king. His style is neat, and bears a considerable resemblance to that of Giles Sadeler. He executed, during his stay in England, a considerable number of portraits.

Wenceslaus Hollar, a native of Prague, born in the year 1607, learnt the art of engraving from Matthew Merian at Frankfort. Having become acquainted with the earl of Arundel during his residence at Cologne, he retained him in his service, and brought him to England, where he was encouraged and patronized by King Charles I. and that nobleman. He engraved a considerable number of pictures, from the Arundelian collection, and portraits of the English nobility, besides landscapes, views, figures, &c. On the troubles of the civil war breaking out, his labours were interrupted; and having joined the royalists he was taken prisoner in the year 1645. On recovering his liberty he retired to Antwerp, whence in the year 1652 he ventured to return to England. During the remaining part of his life he received little encouragement in England; and, notwithstanding his unremitting exertions, and the greatness of his talents, he was totally neglected, and in 1677 he died in great misery. The prints of Hollar are very numerous, amounting to nearly two thousand four hundred. They are generally etched, and are executed with great lightness and spirit. His point is free, playful, and at the same time firm and finished. His views of churches, abbeys, and ruins, are drawn with great accuracy and intelligence of perspective. Some of his landscapes, after the Dutch masters, are managed with great feeling and effect; and his animals, furs, shells, insects, and still-life, are executed with great truth and power of effect. His style is neat, and best suited for a small scale; and accordingly his large plates are not so good as those executed in a smaller size.

William Faithorne, a native of London, (it is not known in what year he was born,) was a scholar of Peake, a painter and printseller, who was knighted by King Charles I. On the breaking out of the civil war he joined the royalists, and was made prisoner at Basinghouse. After being confined some time in prison, by the intercession of his friends he was permitted to retire to France. This circumstance was highly beneficial to himself and the arts of England, as he became acquainted with Nanteuil, under whom he appears to have studied engraving, and from whom, probably, he learnt the art of painting portraits in crayons; and from whom also he derived the style of his engraving, as displayed in his best portraits, which are admirably executed, clear, brilliant, and full of colour: They are very numerous; he also engraved several historical subjects, in which, from his deficiency in drawing, he was not so successful. He died in the year 1691.

William Faithorne, the younger, son of the preceding artist, received his first instructions from his father. The year of his birth has not been recorded. He devoted himself chiefly to mezzotinto scraping, in which he was very successful. His works are for the most part portraits. It appears that he led an irregular life, by which he reduced himself to great distress, and afflicted his father, whereby he hastened his death. He did not survive his 30th year.

There is considerable dubiety with regard to the origin of this art of mezzotinto-engraving, which from this time till the present day has been cultivated, principally in England, with so much success. It has been most commonly attributed in this country to Prince Rupert, nephew of King Charles I. who, going out one morning, observed a soldier cleaning his musket, rusted by the night-dew, and perceiving something like a figure corroded on the barrel, part of which the soldier had scraped off, it occurred to him that some instrument might be constructed to cover a copperplate with such a ground, and that by scraping away the parts intended to be light, the effect of a drawing might be produced; that he communicated this idea to Wallerant Vaillant, a painter then in his service; in conjunction with whom he invented a sheet-roller, cut like a rasp, and thus produced the black ground, which, in some measure, answered the purpose. The prince engraved in this manner a print of an executioner, holding in one hand a sword, and in the other a head, after Spagnoletto, dated 1658. He afterwards engraved, on a reduced scale, the head of the executioner, for Mr Evelyn's *Sculptura*; who assures us that it was given him by Prince Rupert himself, as a specimen of the new art, and as his own invention. But it is positively asserted by Baron Heinecken, that it was invented by Lieutenant-colonel Siegen, an officer in the service of the landgrave of Hesse, and that the work he produced was a portrait of the Princess Amelia Elizabeth of Hesse, engraved as early as the year 1643; and that Prince Rupert learnt the process from him, and brought it to England, when he came over with King Charles II. We have read somewhere, that this print of Siegen was preserved in the imperial collection at Paris, but, after much search, we cannot discover the passage.

Wallerant Vaillant, was born at Lisle, in the year 1623. He became a disciple of Erasmus Quellinus; and afterwards devoted himself entirely to portrait-painting. It is supposed that he came to England in the suite of Prince Rupert. He engraved a number of plates after the Italian masters, and portraits from his own design. He executed also a plate in mezzotinto of Queen Henrietta Maria.

David Loggan, born at Dantzic about the year 1630, is said to have been instructed by Simon de Passe, and afterwards by Hondius. He came to England before the restoration. He was first employed in engraving views of the public buildings of the university of Oxford, and a set of eleven plates of the costumes of that establishment, called "*Habitus Academicorum Oxoniæ à doctore ad servientem.*" He also engraved views of the university of Cambridge, and a great number of portraits, which are his best works,—they are executed entirely with the graver, and are neat, though formal.

Abraham Blooteling, a native of Holland, resided in England about the year 1674. During his stay, which was short, he engraved a few portraits in the line manner, and in mezzotinto, which were much admired at that time.

Peter Vanderbank, a native of Paris, came to England in the year 1674. He had been a disciple of Francis de Poilly, and was an excellent artist. His plates are neat, and highly finished, and many of them are of a very large size,—they are mostly portraits of the kings and nobility of England.

Robert White, born at London, in the year 1645, was a pupil of Loggan, for whom he designed and engraved several architectural views; but his chief works are English portraits, of which he engraved an astonishing number. They are executed with the graver, in a good style. He has also left a few mezzotintos, which are inferior to his other works. He excelled in drawing portraits in black-lead, on vellum, and was also much employed in this way.

George White, son of the preceding artist, was instructed by his father in design and engraving. He also painted portraits in oil and in miniature. His best prints are executed in mezzotinto. His most celebrated plate is a portrait of Bishop Weston, dated 1731.

Hamlet Winstanley, a pupil of Sir Godfrey Kneller, first devoted himself to painting, and went to Italy for his improvement. On his return he seems to have studied engraving. He is best known by the set of etchings which he published after the Earl of Derby's collection of pictures; and another set, after Sir James Thornhill's pictures, in the cupola of St Paul's.

John Smith, probably a native of London, lived about the year 1700. He had been apprenticed to a house-painter in Moorfields, but afterwards learned mezzotinto scraping, first from Isaac Becket, and then from T. Vander Vaart, both very indifferent artists. He was employed by Sir Godfrey Kneller to engrave many of his pictures; and he was the best mezzotinto-scraper that had yet appeared. His plates are very numerous, and consist chiefly of portraits; but he has also executed some historical subjects after the Italian masters.

Simon Gribelin, born at Blois, in the year 1661, came to England about the year 1689, but was little noticed for the first twenty years of his residence there. The first work that raised his reputation, was his copy of Edelink's print of "*the Tent of Darius*," after Le Brun. This was followed by a set of the cartoons, being the first time they had been in a complete set. They had considerable success, though very imperfect representations of the grand style of Raffaelle. He afterwards published several plates, after pictures in the royal collection, and the cieling of the Banqueting House, Whitehall, after Rubens. As the talents and acquirements of Gribelin were not of that extent to do justice to such works, and his plates being on a very small scale, they must rather be considered as *memoranda*, than faithful transcripts of the originals. His drawing is very defective; and though his style is sufficiently neat, he had not sagacity to perceive, nor talent to convey, in his plates, those more minute shades of character which are to be found in those splendid works of art. Gribelin also engraved a few portraits, and numerous book-ornaments. He died in London in the year 1733.

Sir Nicholas Dorigny we have mentioned among the masters of the French School. He came to England in the year 1711, and returned to France in the year 1724. He, as we have already stated, engraved, during his stay in England, his plates of the cartoons, in doing which he had the assistance of Charles Dupuis and Dubosc, whom he invited from France. He also painted several portraits of the nobility.

Charles Dupuis, after assisting Dorigny with part of the cartoons, returned to his native country, and died soon afterwards. He had a brother who also came over, but, not meeting with encouragement, soon returned to his native country.

Claude Dubosc remained in England, and engraved a set of the Duke of Marlborough's battles, with the assistance of Du Guernier, Beauvais, and Baron,—the two latter of whom he invited from Paris for the purpose.

Peter Van Gunst engraved a set of portraits of the English nobility. He never was in England himself; but the plates were from drawings made for the work by Houbraken (not the engraver), who came from Holland in 1713 for that purpose.

Michael Vandergutcht was a native of Antwerp, and scholar of Boutats. His works consist chiefly of anatomical plates. He died in London in 1725.

John Vandergutcht, son of the preceding artist, was born in 1697. He engraved a print of Tancred and Erminia, after Poussin, some of the plates of Cheselden's osteology, and plates of the cupola of St Paul's after Thornhill.

John Faber was a native of Holland. The most considerable of his works were his mezzotinto portraits. He died at Bristol, in the year 1721.

John Faber, the younger, son of the preceding artist, surpassed his father greatly, and was the best scraper of mezzotinto next to Smith. His portraits are very numerous; and are bold, free, and very beautiful.

Edward Kirkall, a native of Sheffield, in Yorkshire, engraved a number of book-cuts. He afterwards made some attempts in chiar' oscuro, uniting the processes of etching, mezzotinto, and wooden blocks. He performed several works in this manner, in which he did great justice to the drawing and expression of the masters he imitated.

James Christopher Le Blon, a native of Flanders. He seems to have been a man of genius; and, to use Walpole's expression, "with a head admirably mechanic." He discovered a method of giving colour to mezzotintos; and perfected many large impressions with tolerable success. He communicated his secret in a thin quarto, in French and English, intitled "Coloritto," or the harmony of colouring in painting, reduced to mechanical practice, under easy precepts, and infallible rules. "Some heads," says Walpole, coloured progressively, according to the several gradations, bear witness to the success and beauty of his invention." This, and other undertakings of his, did not succeed; and he died in Paris, in an hospital, in the year 1740.

Bernard Baron, a native of France, executed a number of portraits, such as those of Charles I. after Vandyke,—the Pembroke family, from the picture at Wilton, by the same,—the Cornaro family, after Titian,—and several historical subjects. They are in rather a coarse open style, but are works of considerable merit.

George Knapton and Arthur Pond were both painters and engravers; they engraved and published, conjunctly, a set of prints from the drawings of the most celebrated painters; they are chiefly landscapes after Claude Lorraine, Guercino, Bolognese, &c.; they are sometimes entirely etched, and sometimes to an etched outline is superadded a washed shadow in the chiar' oscuro manner, with a wooden block; they are very excellent productions. They were also concerned in several other spirited undertakings; amongst the rest, in Houbraken's heads of illustrious English persons. Knapton died in the year 1788, aged 80.

George Vertue, born in London in the year 1684, is a person whose excellence as an artist, love for the art, and industry and zeal in promoting it, entitle him in a very particular manner to our attention. After having been three or four years as an apprentice "to some Frenchman who engraved coats of arms, &c. on plate," and whose circumstances becoming embarassed was obliged to retire to France, he returned to his parents and devoted himself for two years to the study of drawing, and then entered into an agreement with Michael Vandergutcht, with whom he continued for seven years. In the year 1709 he began to work on his own account, and at first was chiefly engaged in designing and engraving for books. "The art was then," says Walpole, "at a very low ebb in England; the best performers were worn out, the war with France shut the door against recruits; national acrimony, and the animosity of faction, diverted public attention from common arts of amusement. At that period the young engraver was recommended to Sir Godfrey Kneller, whose reputation, riches, parts, and acquaintance with the first men in England, supported what little taste was left for *virtù*, and could stamp a character wherever he deigned to patronise. My author mentions, with dutiful sensibility, what joy this important protection gave his father, who had his education warmly at heart, and who, dying soon after, left a widow and several children to be supported by our scarce-fledged adventurer; his own words shall tell how he felt his situation, how little the false colours of vanity gave a shining appearance to the morning of his fortune. 'I was,' says he, 'the eldest, and then the only one who could help them, which added circumspection in my affairs then, as well as industry to the end of my life.' His works began to draw attention, and he found more illustrious patronage than Kneller's. Lord Somers employed him to engrave a plate of Archbishop Tillotson, and rewarded him nobly. The print will speak for itself. It was the ground-work of his reputation, and deserved to be so. Nothing like it had appeared for some years, nor at the hour of its production had he any competitors. Edelinck was dead in France, White in England, Van Gunst in Holland. 'It seemed,' says he himself, 'as if the ball of fortune had been tossed up to be a prize, only for Vertue.' In 1711 an academy of painting was instituted by the chief performers in London; Sir Godfrey Kneller was placed at the head, Vertue was one of the first members, and drew there for several years. To the end of that reign he continued to engrave portraits after Kneller, Dahl, Richardson, Jervas, Gibson, and others. On the accession of the present royal family, he published a large head of the King, from a painting of Kneller. As it was the first portrait of his majesty, many thousands were sold, though by no means a laborious or valuable performance. However, it was shewn at court, and was followed by those of the prince and princess. All concurred to extend his business. In any recess from that, he practised in water-colours, sometimes attempting portrait, oftener copying from ancient or curious pieces which he proposed to engrave. So early as the year 1713, he commenced his researches after the lives of our artists. and began his collection, to which he added prints by former masters, and every thing which could tend to his great work, the history of the arts in England. Wherever he met with portraits of the performers, he spared no pains in taking copies. His journies over England were extensive, and these travels were assiduously employed in making catalogues, observations, and memorandums of all he saw. Robert Harley, second earl of Oxford, early distinguished the merit and application of Vertue. Another patron was Heneage Finch, earl of Winchelsea, whose picture he painted and engraved, and who being president of the society of Antiquaries, on its revival in 1717, appointed Vertue, who was a member, engraver to it;" and during his life the plates published by that society were mostly executed by him. He also engraved for many years the Oxford almanack, and instead of insipid emblems, which had hitherto ornamented it, he for the first time introduced, for its decorations, views of public buildings, and the representations of historical events. Henry Hare, last Lord Coleraine, was also amongst his patrons, with whom he made many journeys through England, designing the antiquities and other remarkable objects, and increasing his store of information for his proposed history of the arts of England. He died at London in the year 1756, universally regretted, and persevering to the last in his exertions. The plates of Vertue are in general executed entirely with the graver; they are extremely numerous, and consist of portraits, views, antiquities of every kind, and book-plates. To his universal exertions we are indebted for the preservation of many interesting monuments of antiquity, besides the numerous portraits from English history. He had also, with infinite labour and industry, collected much valuable information for his history of the arts which he did not live to execute; but which, after his death, being digested and put into regular form by Horace Walpole, constitute the basis of his interesting work, best known by the name of Walpole's Anecdotes.

James M'Ardell, supposed to have been a native of Ireland, born about the year 1710, was one of the best mezzotinto engravers of his time. He has left a great number of portraits, and a few historical subjects, which are highly esteemed. He died in 1765.

J. B. Chatelain, was an eminent English engraver, born about the year 1710, but little is known of his history; he has left several prints after Gaspar Poussin, and others, as well as from his own designs; he was a man of great genius, but leading a dissolute life he neglected the cultivation of his talents; his plates are mostly etched in a fine picturesque manner, and touched up with the graver.

Francis Vivares, was born at Montpellier about the year 1712, but received his instruction from Chatelain, in London, from whom he derived his style of engraving. The prints of Vivares form an era in the history of landscape engraving; to great freedom, firmness, and truth of nature, they unite delicacy and depth of effect, and are executed in a spirited and picturesque style. His plates are taken from the landscapes of the great Italian masters, and principally from Claude Lorraine, whose depth and brilliancy of effect, and graceful style of foliage, he has most successfully imitated; and although not the finest engravings, they possess, perhaps, more of the true feeling of Claude than the works of any other engraver. His plates were brought to great effect with the aquafortis, and afterwards deepened and harmonized with the graver and the dry point. He executed also a considerable number of plates, of a small folio size, after G. Poussin, for the set of landscapes published by Knapton and Pond in the year 1744, from these masters, in conjunction with Chatelain, Mason, Wood, Granville, Major, &c. artists who have caught no inconsiderable portion of the spirit of Vivares.

William Woollett, born at Maidstone in Kent, in the year 1735, was instructed in the art by an obscure artist of the name of Tinney; but his fine style of engraving is entirely his own. He carried the art of landscape engraving to a height of perfection which it never had reached before, and is still unequalled; by a scientific union of the aquafortis, the graver, and the dry point, he gave vigour, firmness, and variety of texture and surface to his foregrounds, and wonderful delicacy to his skies and distances. Without the hardness of Balechou, his plates possess all his delicate finishing, beauty of effect, and much greater freedom and variety. He also engraved several historical subjects and portraits, in which he has been equally successful.

John Browne, born at Oxford in the year 1719, was also one of the greatest landscape-engravers who had yet appeared in England. His plates are executed in a very bold spirited style, first with the aquafortis, and then finished with the graver. They possess great firmness and vigour, but have none of the exquisite delicacy of Woollett. His best plates are of a large size, and, besides their intrinsic merits, are also esteemed from the judicious choice of his subjects; he was occasionally engaged in bringing forward with the etching several of Woollett's large landscapes. In his large print of St John preaching in the wilderness, after Salvator Rosa, he has been peculiarly successful in conveying the bold handling and rugged grandeur of that master; and in Woollett's print of the fishery, much of the beauty of the execution is to be ascribed to Browne, by whom it was first etched.

The landscapes of Woollett we conceive to form the very perfection of that department of the art; and though it had been cultivated successively by several eminent artists, it was only by slow stages that it arrived at this pitch of excellence. The landscapes of Cornelius Cort after Girolamo Muziano da Brescia, of Bolswert after Rubens, and of Baudet after N. Poussin, exhibit various degrees of perfection, as attained solely by the graver. The works of Cort display much grandeur of composition, and are executed with great firmness, and with a vigorous stroke, but the effect of the chiar' oscuro and local colour is not attempted. In the landscapes of Bolswert we see the same imperfections, but in a smaller degree, as he was necessarily led to convey as much of the brilliancy of effect of the originals, as the unmanageable nature of the instrument, and the imperfect knowledge of the capabilities of the art, would permit. The landscapes of Baudet are a great step towards perfection; there is a considerable power of local colour and chiar' oscuro, and much fine detail and minute character; there is, however, all the heaviness peculiar to works of this sort executed entirely with the graver, and a want of that spirit and variety of texture which the point only can give. By carrying on his works with the point, and leaving the graver only to harmonize his effect and deepen his tints, Vivares accomplished a great and important revolution in the art, and laid the foundation of the great superiority which we conceive that the English school of landscape possesses over every other. The style of Vivares is marked with a character of great spirit, and he seems to have been more solicitous to produce a faithful transcript of the picture he copied, than to add the attractions of smoothness of workmanship, and accordingly shews more the taste and feeling of the painter, than the laborious mechanism of the engraver. Woollett united these qualities, and remains still unrivalled.

R. Cooper was a respectable engraver in Edinburgh, who flourished before the middle of the 18th century. In forming an estimate of the talents of this artist, considerable allowance must be made for the neglected state of the art in Scotland at this time, and the nature of the employment to which he was obliged to descend, which consisted chiefly of book-plates and such other miscellaneous works as usually fall to the lot of a provincial artist. From the information of those who have had an opportunity of judging, we are assured that his talents were of a higher kind, and that he thoroughly understood the principles of his art. Of this the most tangible evidence we can offer is, that he first had the sagacity to discover the genius of Sir R. Strange, recommended him to devote himself to the art, and first directed his studies and improvement. Cooper has left a son, an artist of considerable merit, who has designed, and engraved in aquatinta, several views in Rome and some other works; but having been employed about her Majesty's person in the capacity of drawing-master for many years, has long given up the art of engraving.

Sir Robert Strange was descended from an ancient family in the county of Fife, in Scotland, but was born in Orkney in the year 1721. He had been originally destined for the law; having shewn considerable talent in drawing, he was persuaded to renounce his profession and devote himself to the art, under the tuition of Mr R. Cooper, who is already alluded to. About the year 1746 he went to London, and dedicated his attention to engraving with considerable success, and soon afterwards formed the resolution of visiting Paris for his further improvement in the art. On his way to that capital he spent some time at Rouen, frequenting the academy, where he obtained an honorary prize for his design, notwithstanding the number of competitors. On his arrival at Paris he became a pupil of Le Bas, from whom he learned the use of the dry point, which he adopted with such wonderful success in his subsequent works. It is probable that at this time he executed his print of the "*Retour du Marché*" after Wovermans, a work executed with all the lightness, freedom, and taste of Le Bas. In the year 1751 he returned to England, and devoted himself entirely to historical engraving, of which he may be considered the father in respect to England. In the year 1761 he visited Italy, in order to make designs for engravings which he had projected from the works of the great Italian masters, and during his stay in that country was made a member of the academies of Rome, Florence, Bologna, Parma, and also of Paris. In the year 1787 he received the honour of knighthood, and died in 1792. The engravings of Strange consist of about 50 plates, for the most part taken from the works of the great Italian masters. They are distinguished by a bold and vigorous, and at the same time delicate execution, with much depth and variety of colour, and harmony and breadth of chiar' oscuro. By the scientific union of the point and the graver, he produced an effect of softness and delicacy in his female flesh which no other engraver has ever attained, and which forms one of the most distinguished excellencies of his prints. It must, however, be allowed, that his drawing is often feeble and incorrect, and that his extremities, particularly of his females, are very defective.

Luke Sullivan, a native of Ireland, was a disciple of Thomas Major; his chief works were engravings after Hogarth, and the Temptation of St. Antony after Teniers; he also engraved several landscapes which he had drawn from nature, and practised miniature-painting with great success. He died about the year 1765.

Simon Francis Ravenet, was a native of France, but he settled in London about the year 1750. He executed several large plates in a bold and vigorous style, after the Italian masters, chiefly for the Boydell collection. He assisted Hogarth in many of his plates; he has also left a whole-length portrait of Lord Camden after Reynolds, from the picture in Guildhall, and a great number of vignettes and book-plates. He died in 1774.

William Wynne Ryland, born in London in the year 1732, was originally a pupil of Ravenet, and afterwards went to Paris for improvement, where, under Boucher, he cultivated with much success the study of design, and also applied with much assiduity to his further advancement as an engraver. During his residence at Paris, he executed several plates after Boucher, the most celebrated of which is the Jupiter and Leda, a work of a large size, and usually considered the best of all his plates. "He has there," says a contemporary writer, "displayed great power as an engraver in lines; the print has a fine transparent tone; he has tempered the flimsy touchiness of the French taste with a portion of Ravenet's solidity; the soft firmness of flesh is ably characterised in the figure of Leda, and the delicacy of the swan and various textures of the surrounding objects, are rendered with much feeling and judicious subserviency to the principal parts." The great mass of Ryland's subsequent works, however, are executed in the chalk manner, which, considering the excellencies which his line engravings display, is a circumstance which gives us the deepest regret that he should have relinquished the highest walk of his art, in which he was so eminently qualified to shine, to degrade his talents by devoting them almost exclusively to stippling. On this subject, the judicious writer we have just quoted justly observes: "It was not, however, the false taste of Boucher that turned aside Ryland's talents from the mark which he was evidently and successfully aiming at when he produced his Jupiter and Leda, but a fashion *of stippling* which he learnt in France and introduced with his own modifications into England. Stippling with the graver had been occasionally practised both by Martin Schoen and Albert Durer in the very infancy of the art; the latter employed it in the soft texture of beaver hats, as well as on some other occasions. Perceiving that it was peculiarly expressive of softness, Agostino Veneziano and Boulanger sometimes stippled their flesh, and Julio Campagnola his back-grounds also. Almost a century afterwards, it was observed by de Marteau, who was then living, that by etching some of the dots of which this sort of engraving consists, and engraving others, very successful imitations of drawings hatched with chalk might be produced. But Ryland employed stippling so as rather to imitate such drawings as are *stumped* than such as are *hatched* with chalk, by which means he softened down all energy of style, and has left posterity to regret the voluntary emasculation of the powers he had manifested in engraving, which is the subject of the above comments. Soon after his return to England he engraved in lines a portrait of the queen after Coates, and that portrait of his Majesty after Allan Ramsay, which Strange, from a misunderstanding either with the Earl of Bute or Ramsay, had declined; but they possess neither the vigour nor taste of his Jupiter and Leda. From this time he was appointed engraver to the king, and received an annual salary." His other works are chiefly in the chalk manner, and in general from the pictures of Angelica Kauffmann. "Ryland's engravings in this novel manner," says the writer we have just quoted "were for the most part printed in red, and this manner of engraving soon obtained the name of the 'Red-chalk manner,' and was run after with avidity by the public. With so much heedless anxiety was it pursued, that people never stopped to consider whether even red-chalk or stumped drawings themselves, of which these prints were professed imitations, were so good imitations of nature, or afforded means so happy and efficient of transfusing the soul of painting, as the art which had previously existed of engraving in lines, and which was then practised in high perfection by Bartolozzi, Strange, Vivares, and Woollett; it was enough that it was new, and red; Ryland and novelty led the way, and fashion and the print-sellers followed."

Edward Rooker, born in London in the year 1712, was a designer and engraver of considerable eminence, and is justly celebrated for his architectural views, which are correct representations of the buildings, and display a profound knowledge of perspective. He also executed several etchings after R. Wilson in a fine clear manner, which are highly esteemed.

Michael Angelo Rooker, son of the preceding artist, was born in London in the year 1743. After receiving some instruction in engraving from his father, he became a pupil of Paul Sandby, from whom he learnt drawing and landscape painting. He has engraved a great number of Oxford almanacks, in which he has introduced, from his own designs, the best views that have been taken in that city. In these plates he has displayed, like his father, great knowledge of perspective; his effect is broad and clear, and his style bears considerable resemblance to that of Piranesi. He was also for many years principal scene-painter to the Hay-market theatre.

John Hall, born about the year 1740, was also an engraver of history and portraits. His style is bold and clear; his best plates are the battle of the Boyne, Penn's treaty with the Indians, and Oliver Cromwell dissolving the long parliament, all after Mr West, and a few English portraits after Reynolds, Gainsborough, &c.; they are all works of great merit, and highly esteemed.

Richard Earlom is an engraver who has contributed largely to the advancement of the art in England, and seems to have been chiefly employed by the Messrs Boydells. We have no access to other information concerning him than what his own plates afford. During a long life, he practised the art with unremitting industry and great success. His plates consist of etchings, portraits in mezzotinto, historical subjects and landscapes in various styles, in which he has united the practical skill of the engraver to the feeling and spirit of the painter. He executed, among the rest, the celebrated work called the *Liber Veritatis*, being imitations of 200 original drawings of Claude Lorraine, in the possession of the Duke of Devonshire, to which he a few years ago added a supplement from similar works of that master, in the possession of other eminent collectors. Into these works he most happily transfused the spirit and character of the originals; they are executed in mezzotinto with an etched outline, and have a charming effect.

Captain William Baillie, born about the year 1736, was a native of Ireland, and passed the early part of his life in the army, from which he retired with the rank of captain of cavalry. After leaving the service he devoted his attention entirely to the cultivation of the art, and executed about an hundred plates in different manners, principally after the Dutch masters. He imitated the style of Rembrandt with great success, and also copied some of his best etchings, such as the gold-weigher, the three trees, &c. he also retouched, in the original style, Rembrandt's "hundred guilder print," the plate of which he had purchased in Holland in a state of perfect ruin, having long lain neglected and corroded with damp. The restoration of this plate was performed with great success, and was a signal obligation conferred on the lovers of the art, as this is one of Rembrandt's finest works, and is a happy illustration of the principles of his chiar' oscuro. Without the strong character and expression, and vigorous and rich style of execution of Rembrandt, the plates of captain Baillie command our admiration, by the fidelity wherewith they convey the character of the originals, by the harmony and breadth of their chiar' oscuro, and the beauty and neatness of execution.

Thomas Worlidge, a painter of miniature and portrait, flourished about the year 1750; but not succeeding in these arts, he applied to engraving, and executed a number of etchings, chiefly heads, in the style of Rembrandt. Although they are destitute of the fire and spirit of that extraordinary artist, they are respectable productions, and held in some estimation. He executed a set of antique gems which are now become valuable, and a large print of the installation of the Earl of Westmoreland as chancellor of the university of Oxford; a work of great labour, containing a great number of portraits, but much more curious than valuable as a work of art.

John Baptist Jackson, was an English engraver on wood, who flourished about the year 1740. He went first to Paris and became a pupil of Papillon, and afterwards visited Venice, where he executed a number of chiar' oscuro prints, after the great Italian masters, besides vignettes and book ornaments.

David Martin, a portrait-painter of high reputation in Edinburgh, who died about the year 1795, is entitled to a place amongst the engravers of the English school, from the extraordinary success with which he occasionally cultivated the art. He executed, in mezzotinto, plates of Rousseau and David Hume, after his preceptor Allan Ramsay; a pair of landscapes with cattle, after G. Poussin, etched and finished up with the graver to considerable effect; but his best print is a large folio portrait of Lord Mansfield, executed chiefly with the graver, in a style which entitles it to rank among the finest English specimens of portrait-engraving. It has been frequently doubted that this plate was really the work of Martin, but we have been assured by artists who lived in habits of intimacy with him, that there was no reason to doubt of the fact, and that he derived no other assistance in carrying it forward than is usual in executing a work of such labour.

Candour, however, obliges us to make considerable deductions from the merit which Martin claims for this print. It was originally intended to have been entirely executed by a French artist, whose name has not been recorded; this person leading an irregular life, and being of dissipated habits, either died or had the plate taken from him while it was yet not greatly advanced. It is certain that Martin then engaged upon it himself, and that he completed it after devoting two years to it. It is probable that the greater part of the lines were all laid on the copper by this artist, and that the finishing the details, and harmonizing the whole, were the work of Martin, and in this opinion the internal evidence of the work itself will sufficiently bear us out.

Valentine Green, born in Warwickshire in the year 1739, was at first destined for the law, but from his love to the art he placed himself with an obscure engraver in Worcester; but not succeeding to his wishes under this preceptor, he came to London, and directing his attention to mezzotinto scraping, without any instruction, became one of the best artists in that department. He has left a great number of portraits and historical subjects from the best masters. In 1789, he obtained a patent from the elector of Bavaria for the exclusive privilege of engraving from the pictures in the Dusseldorf gallery; and he accordingly executed 22 prints from that collection, with the most flattering hopes of ample remuneration, when the gallery was laid in ruins during the siege of that city by the French in the year 1798, by which catastrophe he lost most of his property, and his prospects were blasted. On founding the British Institution for promoting the fine arts, he was appointed keeper. He died in the year 1813.

Of William Hogarth we have already treated as a painter; as an engraver we are indebted to him for the very spirited works he has published from his own pictures, of which they are faithful transcripts; they are in general etched with great spirit, and finished with the graver. His heads are full of character and expression, and his prints convey a very distinct idea of the originality of manner and conception of this extraordinary person.

Paul Sandby, born at Nottingham in the year 1732, was a landscape painter of great eminence, and father of the English school of water-colour painting. He etched several plates of landscapes in a neat spirited style; but we mention him in this place for his excellent prints in the new art of aquatinta, done from his own designs, and representing chiefly views in North and South Wales, executed in imitation of bistre drawings. This art, which has been so extensively and successfully cultivated in our own time, was practised first in Paris by Le Prince, and introduced into England by Sandby, who greatly improved it.

Andrew Bell was a respectable engraver in Edinburgh, who flourished about the middle of the eighteenth century. He was endowed with good natural parts and considerable talents as an artist; he has, however, left nothing to convince posterity of his talents, except the names of a few pupils, who have conferred honour on their preceptor and their country. He was very extensively employed in book-plates and other works, which tended more to the acquisition of an ample fortune than to the cultivation of his talents and the foundation of his fame. He was one of the original projectors and proprietors of the Encyclopedia Britannica,—one edition of which contributed greatly to the advancement his fortune.

F. Legat, a disciple of A. Bell, just mentioned, was an artist of great genius. Going early in life to London he was engaged on many great works, and became one of the most eminent engravers of his time. His plates are executed in a fine finished style, in which he seems to have adopted for his model the works of Sir Robert Strange. His plates are in general of considerable magnitude; among others, he has left Andromeda, after Runciman; an early work; Mary Queen of Scots resigning the crown, after Hamilton; the continence of Scipio, after N. Poussin, a scene from Hamlet, after West, and one from King Lear after Barry,—the two last were engraved for the Shakespeare gallery. As he died in the prime of life, his plates are not numerous.

Daniel Lizars, also a pupil of Bell, has engraved a few portraits of eminent Scottish characters, in a bold firm style; but he chiefly devoted himself to book-plates and other miscellaneous works, which afford no opportunity of displaying genius. He died in the year 1812, leaving a son, W. Lizars, an eminent painter of conversations, and of whose talents as an engraver the readers of this work will find numerous specimens to commend and admire.

Mr J. Beugo, also a disciple of Bell, has executed a few large portraits from Vandyke, Raeburn, and others, which reflect the highest honour on the Scottish branch of the British school.

The reputation of the English school of engraving is still ably maintained by its present race of artists. To the department of history, the public taste has indeed afforded little encouragement, although there are many artists who have shewn every requisite to excel in this difficult and arduous pursuit,—as the works of Holloway, Sharp, Bromley, Heath, and many others sufficiently prove. Portraits have been in England generally executed in mezzotinto, a mode admirably calculated to express the peculiar breadth of manner of this school, and on a smaller scale they have been usually engraved in stipple or the chalk manner. The taste for heroic landscape having almost entirely disappeared, the talents of our numerous landscape-engravers have for many years been dedicated to topographical subjects, architectural antiquities, and book-plates, works which, although they tend little to expand the genius or refine the taste, have been at least the means of eliciting much beautiful execution, and which it is to be hoped in the revolutions of public taste will be again directed to objects of a more elevated character, and more worthy of a school which produced a Wilson and a Gainsborough, a Vivares and a Woollett. Wood-engraving has within our own time been cultivated with great success, and brought to greater delicacy and beauty of effect than had ever been known in former times; it is now almost exclusively applied to book decorations, to which it is well adapted, as the block is inserted into the form along with the printing types, and printed off at the same time. We have also seen an application of the art of wood-engraving from separate blocks in the chiar' oscuro manner, like paper staining or floor-cloth stamping, by which landscapes and figures may be printed off in imitation of water-colour, bistre, or Indian ink drawings. In this process, when much variety of colour is required, the number of blocks must be increased; the simple colours, that is the blue, red, and yellow, requiring a separate block, and the compound ones, green, purple, brown, &c. being produced by printing their elementary colours separately; thus if a green is required, the stamps which print the blue and yellow are made also to pass over that part, and these neutral tints and modifications of the brighter colours will be effected by the introduction of the stamps of the other suitable colours over them. This very ingenious application of the old art of chiar' oscuro engraving was invented, we believe, by Mr Savage, an eminent printer in London; the examples we have seen were given as specimens of a history of decorative painting, which he is now about to publish, and in which he promises to explain the whole process of this mode of the art, and the methods of preparing the various coloured inks. From the beauty of these specimens, it is obvious that it is a very important acquisition to the art, and possesses very great and important capabilities.

Sect. VI. *Practice of Engraving.*

Stroke-engraving, or the line manner, is the most ancient and most difficult mode of engraving.

The outline being traced on the copperplate with an etching needle, the effect is produced by cutting the lines with the burin or graver, varying their direction, character, and depth, according to the quality of surface, perspective situation, or condition with regard to light and shade of the respective objects. The operation of cutting or ploughing the lines, is performed by pushing forward the tool parallel to the plane of the copperplate. The graver is an instrument in the form of a quadrangular prism, inserted into a wooden handle. It is usually about four inches long, and varies in thickness according to the strength of line which it is intended to cut. but usually about the tenth of an inch; and the point is formed by bevelling off the end diagonally from the upper to the lower angle; and for very fine lines, the sides should be at such angles with regard to each other, that their transverse section should present the figure of a rhomb or wedge, the acute angles of which are at the top and bottom. In order to admit using it in the horizontal position, it is slightly bent upwards towards the end next the handle. It is sharpened by rubbing its diagonal surface on a hone or Turkey-stone.

The scraper is a sharp three-sided instrument, like a triangular file, and tapering to a point. Its use is to scrape off the barb that is formed on the edges of the lines, whether executed with the graver or point. The oil-rubber consists of a roll of felt or woollen cloth, tied up tightly; it is commonly applied to smooth the surface of the copper after the scraper has been applied; it is always used along with a little olive oil.

The burnisher is a steel instrument, used for polishing the surface of the copper when any erasure has taken place, or to reduce the depth of the lines when they have been made too deep, and thereby produce too dark an impression.

In executing a regular stroke-engraving, one of the greatest difficulties is *laying* the lines, that is, determining the direction and character of the lines, in order to produce the best possible representation of the various objects, according to their different qualities and circumstances; and this faculty can be attained only by a scientific examination of the modes adopted by the best masters,—imitating their beauties, and avoiding their errors. The laws of linear perspective will also be an important auxiliary in this very arduous part of the art. By it the direction of the lines is considerably modified, and the qualities of roundness, flatness, concavity, convexity, and the like, are represented with greater strength and accuracy. Thus, the representation of a flat smooth surface, for instance, may be made by courses of lines, lying either horizontally, perpendicularly, or diagonally, or perhaps by a combination of all these, according to the style or manner the artist finds best suited for the purpose; but these lines are not always distributed in their exact geometrical arrangement, but follow the direction indicated by the perspective situation of the part, whether lying above or below the point of sight, whether in a horizontal, vertical, or an inclined direction; and the horizontal lines of any part of an object, which converges to a vanishing point, will also be carried in that direction. Diagonal and curve lines are in like manner regulated, so as to present the appearance that such lines would have if drawn geometrically on the real object, and viewed from the point of sight; and upon the same principle, convex and concave objects, cones, cylinders, and every modification and combination of these figures are regulated; and to this rule are also referable even those figures which possess the greatest variety of irregularity of surface and texture. Forming, as this does, one of the greatest difficulties and greatest excellencies of regular stroke-engraving, and being also an important element in etching and various kinds of drawing, we are anxious to be clearly understood. We shall trouble the reader with one more illustration, and for this purpose we shall chuse a cylinder: This object may be finished with lines, either directly transverse, diagonal, or like the style of Piranesi's columns, longitudinally, or parallel to its sides, or by a combination of any two, or of all these modes. If the cylinder or column be placed in a direction parallel to the ground line, and thus undergo no change in its perspective figure, the longitudinal lines will be geometrically parallel to its sides. If it be placed on the ground, oblique or perpendicular to the ground line, the lines will follow the direction of, and converge to the same point as its sides. If the finishing consist of transverse lines crossing it like a series of rings, they will follow the direction that annular lines would assume if actually marked on such a figure, and viewed from the point of sight; and in lines running diagonally the same principle will equally apply; and in these complicated effects, where richness, depth, and the like, render it necessary to combine those various species of lines, each will follow the direction which it would have taken had it been adopted by itself. Besides the mere direction of the line, its character as to strength, smoothness, continuity, &c. will be determined by the quality of the object on which it is employed, whether flesh, hair, fur, drapery, rock, metal, or the like; but for this no rule can be laid down, and attentive examination of the works of the best masters will be the only sure course of study in this essential part of the science of engraving.

The old masters, in conducting their plates, after tracing the outline, proceeded immediately with the graver, with which they executed the work entirely; and on this principle almost all the works of Marc Antonio and his school, Albert Durer, Cornelius Cort, Agostino Caracci, Goltzius, Bolswert, &c. were conducted. As the capabilities of the point became better understood, its assistance was called in; it was used with great success, and was an immense improvement to the art, as affording the means of giving much lightness and freedom of effect, variety of character and surface, not to mention the greater expedition with which a large work may be executed. And, accordingly, since this was discovered, every plate, from the largest to the most minute work, is now brought to a state of considerable effect by means of the etching ground and point; it is then harmonized with the graver, and the lights in the more delicate parts are tinted with the dry point, that is, with the mechanical operation of the etching needle, without the etching ground and aquafortis.

The use of the dry point, as applied to the more delicate parts of a finished engraving, is comparatively a recent invention; and although we believe it was occasionally employed by some of the great French artists of the 17th century, we are of opinion that it was Sir Robert Strange and Woollett who first displayed its great and extensive utility.

Sect. VII. *Of Etching.*

This mode of chalcography, from what we have said above, has evidently contributed most essentially to the perfection of the art of stroke-engraving, properly so called, by the lightness, freedom, and variety which it has given to the style of modern art. But it has likewise strong claims to our gratitude, from having been the means of preserving many of the first thoughts, sketches, and compositions of the great painters, who, from the facilities which it afforded, have been led to amuse themselves with the point, and have left many etchings, highly estimable as faithful transcripts of their character and modes of thinking, and in many points supplying the absence of original pictures, as far as relates to composition and form in general, and light and shadow. To it, then, we are indebted for those precious remains, exhibiting the grace and beauty of Parmeggiano, Baroccio, Guido, Annibal Caracci, Pietro Testa, and the like; the landscapes of Claude Lorraine, Swanevelt, Both; the cattle-pieces of Paul Potter; and the charming chiar' oscuro of Rembrandt.

Etching is performed, first, by covering the copper with a varnish, or etching ground as it is called, and then scratching with the point or etching-needle the design, with all its intended shading and effect; when this part of the process has been finished, a wall of bordering wax, as it is called, is put round the plate, and the aquafortis is poured on, and permitted to remain till the work has been corroded to sufficient depth. From what we have described of this process, it will be perceived that, as the strength of the line depends more on the length of time that the aquafortis remains on the plate than its depth as marked with the point, the point may be handled, if necessary, with all the freedom of a pen or pencil; and being equally capable of firmness, and hardness, and delicacy, it may be adapted to every sort of object. In architectural subjects, the outline and shading may be executed most advantageously with the parallel ruler, and, by breaking the continuity, or waving the lines in their course, in a serpentine direction, they will still retain their freedom of character, and may be applied to any purpose that may be required,—and of this the admirable views of Piranesi will afford many excellent examples.

In such subjects or parts of an engraving where it is required to produce a flat tint, by a number of straight lines, either equi-distant, or diminishing in regular gradation from a greater distance to less, as in skies, machinery plates, and the like, the lines are usually performed by means of the ruling-machine on the etching-ground. This instrument was invented some years ago by Mr Wilson Lowry of London, and is one of the greatest improvements of modern art; its action is perfect; and, when performed in the best manner, produces all the smoothness and uniformity of a tint or wash of Indian ink. When lines have been drawn with the knife, as it is called, they are bit with the aquafortis to a sufficient depth; and, in order that they may not extend further than the part intended to be ruled, they must be covered over with the stopping-up varnish on the parts not intended to be corroded with the aquafortis.

In order to contribute to the greater strength or delicacy of the lines in the etching, the points of the different etching-needles are sharpened according to the purpose for which each is intended, at an angle of greater or less acuteness; the sharpest points, of course, making the most delicate lines; this variety in the strength and firmness of the lines is also greatly assisted by the depth to which the plate may be corroded by the aquafortis; and, accordingly, when a plate requires, in its different parts, different degrees of strength, this variety is given by corroding one part of the plate, while the rest is defended from the action of the acid by means of the stop-ground; and, thus gradations of depth to any amount may be produced by pouring off the aquafortis when any part is sufficiently dark, covering it up with this varnish, setting it aside to dry for a little, and again replacing the acid, and so on. When the plate is judged to be bit to a sufficient depth in every part, which may, after some practice, be ascertained by removing with the scraper a small portion of the ground on the part to be examined, the bordering wax is taken away, and the ground cleaned off completely by means of oil of turpentine, applied with a piece of rag; and if any part be too hard to be easily removed by it, it may be assisted by placing under the plate a flaming torch or piece of paper.

It frequently happens that, after an impression has been taken, some parts of the plate are found to be too dark, while other parts are deficient in strength or *colour*; in the former case, the scraper and burnisher will remedy the evil; in the latter, the lines may be re-touched with the graver to a proper depth; but if the style of the lines does not admit of the graver, it may be done by laying on a new etching-ground as at first, and re-entering the lines with the point, and as the ground is thin they will appear sufficiently distinct through it to be seen without difficulty.

Re-biting is another process, by which the lines which are too light may receive a greater depth; it consists in heating the plate to a moderate temperature by laying it on a hot iron, and covering it over with a fresh etching-ground by means of the *dabber*; this instrument, which we shall presently describe, lays the ground accurately over the flat part of the plate, while the lines that have been bit are left uncovered, and when sufficiently done it is ready for the aquafortis as before. This process is a very recent invention, of great importance to the engraver; but being a work of considerable nicety, it requires some experience to manage it dexterously. It is obvious that the plate must be bit to a certain depth before this process can be adopted with success, and that at all times, from the extreme tenuity of the ground, much circumspection must be had, while the aquafortis is on the plate, to examine with the magnifying glass that it does not *bite foul.* For supplying the dabber with the etching-ground in sufficiently minute quantities, in order to avoid clogging up the lines, the ground may be kept in small quantities in a soft state on the corner of the warm copperplate, and may be renewed at pleasure.

The etching-ground is a substance made up of asphaltum, bees-wax, &c. fused together in an iron pot; and, in order to preserve it from dust, it should be kept tied up in a piece of silk taffeta, or Persian. Of the various modes of composing it, we shall treat more minutely afterwards. In laying the etching-ground, the copperplate must be held with a hand-vice or pair of pincers; and in order to avoid scratching it, a ply or two of paper may be put between them. The plate is then to be heated moderately by means of a blaze of paper or a lighted torch; the ball of etching-ground (still in its envelope of silk) is then rubbed over it, and, by its heat, extracts the ground from its bag; the dabber is then to be applied by touching it smartly all over (in a manner somewhat like the application of the printers ink to the types with the balls) till the whole has received an uniform coat; the plate is then turned with the face downwards, and the flame of the torch or candle is made to pass over its surface, in order to make it perfectly smooth, and the black colour which its smoke communicates is of great advantage in shewing the lines distinctly as the work proceeds. In passing the flame over the surface of the ground, it must be kept continually moving along, as there is much danger of burning the ground, and consequently of rendering it unfit for defending the plate from the action of the acid.

The dabber consists of a little cotton, tied up in a piece of silk stuff, in a hemispherical form, of about two inches diameter; and, in order to preserve its shape, some inclose behind the cotton a circular piece of thin pasteboard. The use of this is for laying on the etching-ground.

As the etching-ground is too soft to allow the hand to rest upon it while the work is going on, a board is used for this purpose, called the *bridge* or *rest* which is raised a little above the surface of the plate by means of a thin piece of wood at each end.

The outline ought to be drawn out on paper in black-lead, or for greater expedition, when circumstances will admit, traced on oiled paper. It is then damped and applied to the surface of the etching-ground, face to face; and being put through the rolling-press, as much of the black-lead is transferred to the ground as will be a sufficient indication of the forms of the several parts, which will, of course, appear the reverse way.

While the etching is going on, a blind of tissue paper should be placed before the window, which will take off the glaring effect of the lines, and allow them to be seen better.

There are several ways of making the etching-ground; the best is what is usually called Hollar's ground, and is made as follows: Take of virgin wax and asphaltum each two ounces, of black and Burgundy pitch each half an ounce; melt the wax in a new earthen glazed pot, and add to them by degrees the asphaltum reduced to a fine powder; boil the whole, till, by taking out a drop on a plate, when cold it will break on bending it two or three times between the fingers; it is then taken off the fire, and allowing it to cool a little, is poured into cold water. It is now in a soft state without being fluid, and must be wrought up, drawn out, and pressed with the hand, in order to mix the ingredients perfectly, then rolled into balls, and tied into Persian or taffeta for use.

Another good ground may be made with two ounces of white wax, two ounces of asphaltum, an ounce of common pitch, and an ounce and a half of Burgundy pitch, to be treated in the manner above described.

The bordering-wax, or wall for containing the aquafortis, is composed of one pound of Burgundy pitch and half a pound of bees-wax, melted over a slow fire in the manner above described, to which will be added a gill of olive oil; it is be poured into water as above, and put up into rolls for use. In surrounding the plate with this mixture, previously to biting it with the aquafortis, there is some difficulty in working it freely; but it is rendered perfectly pliable by softening it in a little warm water, and then working it into a ribbon-like shape with the hand.

Of the aquafortis.—This substance presents considerable difficulty to those who are inexperienced in biting their plates, and its activity, when of any given strength, varies according to the temperature of the atmosphere; it is greatest during warm weather; accordingly, no precise rule can be given, but in general its most convenient strength is when the pure nitric acid is diluted with about four times its bulk of water, and it may be proved, with a little experience, by previously trying its action on a separate piece of copper. As it has a great tendency to assume the aeriform state and lose its strength, it should be kept in glass bottles, and closed with a ground stopper of the same material, as corks are speedily corroded.

The stop-ground is composed of the best turpentine varnish, to which is usually added a little lamp-black to give it a body; it is to be applied where required with a hair pencil. It may be also made up with half a pint of spirits of turpentine put into a bottle, to which is added finely pounded asphaltum, till it be of sufficient consistency.

Of etching on the soft ground.—This process is entirely a modern invention, and is well suited for making imitations of black-chalk drawings. It is performed by covering the plate with a ground made considerably softer than that used in the other mode, and laying upon that a piece of thin paper, fixed to it by means of a little of the bordering-wax, to prevent its shifting its position on the plate; the design proposed is then made out with a black-lead pencil, and wrought up to the effect intended upon this paper; the friction of the pencil takes off the ground from the part intended to be bit with the aquafortis, which is applied in the usual manner, and the work receives different degrees of depth as required by means of the stop-ground. The tint produced by the soft ground has a granulated texture like chalk, and is capable of considerable variety, by interposing, between the ground and the paper on which the design is drawn, a piece of silk, taffeta, or Persian, by which its appearance may be modified according to the texture of the stuff.

Soft ground.—The soft etching-ground is considerably affected in its manner of working by the temperature of the air, and accordingly different compositions are used according to the season of the year. For a soft ground for summer, a convenient substance is made by melting together one-third of bees-wax and two-thirds of hard etching-ground, in a glazed earthen pot. For winter, the soft ground is best made with one-fourth of hog's lard and three-fourths of hard etching ground, melted in the manner above described. These soft grounds are applied to the copper in the same manner as the hard ones already described.

Stippling, or the chalk-manner.—This mode of engraving is performed on the etching ground by means of the point, and is then corroded with the aquafortis, The effect in stippling is produced entirely by means of dots closely put together, and has the appearance of chalk-drawing. In our history of the English school, having treated of the defects of this mode of engraving, our observations need not be repeated. The chalk-manner may be executed in two differentstyles, imitating either drawing hatched with the point of the chalk, wherein the strokes are seen, or those done with the stump, whereby the chalk is scraped to a fine powder, and rubbed on in flat tints without any appearance of lines or hatching. The dots in either manner are executed in the same way, and are made larger or smaller, as required, by means of different etching-points. In order to give freedom to the work in imitating chalk sketches, an instrument has been sometimes used, consisting of a number of points arranged like the radii of a circle, which being fixed into a steel axis, on which it is allowed to revolve, a number of dots is made with considerable rapidity; but this instrument is of very limited application, and is little used. The chalk-manner was some years ago very much practised in large historical works; but fortunately for the arts the fashion is now gone, and its application is in general confined to smaller portraits, for which it is admirably adapted.

Engraving on steel.—This art is applied chiefly to the cutting of punches, matrices, and dies for coins, medals, and the like; the engraving of the device is performed in relievo from a wax model, with gouges and chissels, &c. upon steel, rendered as soft as possible in order to be cut with greater ease; when finished it receives a very high temper. The piece of steel intended for the matrix or mould is made red hot, and by the blows of a hammer is impressed in reverse with the device as executed on the punch, and any deficiencies are supplied by means of the tools used; it is then tempered to a proper hardness, and is now fit for use.

Etching on steel.—This is chiefly employed on the devices of sword-blades, and is performed by drawing the design intended on the steel, with Brunswick black and a hair-pencil; it then receives a border of wax, as in etching on copper, and the aquafortis is then poured on and left to corrode it to a sufficient depth; it is then cleaned off with a little turpentine.

Etching on glass.—This art is chiefly applied to the ornamenting of crystal goods, and graduating glass vessels, and is founded on the affinity that fluoric acid has to siliceous earth, which forms one of the bases of every species of glass. We do not profess to be acquainted with the details of the process as practised in the large way, which is kept secret by glass ornamenters; but its general principle is, that the design is drawn with a varnish capable of resisting the action of the acid, which is then applied to the glass, acting only where it is not covered with the varnish. The fluoric acid is not applied in its simple form, but is exhibited as contained in the fluor or Derbyshire spar, finely pulverized, from which it is expelled, in the gaseous state, by the addition of a little sulphuric acid. From this it is evident, that the fluor spar must be put into a vessel capable of resisting the action of either acid, and that the work to be corroded must be enclosed in a convenient apparatus to prevent the escape of the gas. The appearance presented by the corroded part of the glass is that of an unpolished mirror, and has a fine effect by the contrast with the part defended by the varnish, which of course retains its original clearness. The process may be varied, and much minuteness of detail given, by covering the whole with an etching ground or varnish, and scratching the design with an etching needle, and where thick lines are required, with pointed pieces of wood, ivory, &c.

Sect. VIII. *Aquatinta and Mezzotinto Engraving.*

Aquatinta.—This mode of engraving is an imitation of Indian ink or bistre drawings,—and, when printed in colours, even of water-colour drawings, whence it derives its name. It is performed by covering the copperplate with a resinous ground, of which there are many varieties, and which, if corroded with the aquafortis in this state, would give, according to the quality of the mixture, a uniform tint over the copper like a wash of Indian ink, which would be more or less deep according to the length of time it is bit, or the strength of the acid. In those parts of the plate where no tinting is required, the lights are stopped out with the varnish; and the plate, after being surrounded with the bordering-wax, is subjected to the action of the acid. When this has been sufficiently done, the aquafortis is then poured off, and the stop-ground or varnish again applied where it has not been sufficiently corroded; and this alternation of the varnish and acid is repeated till the whole work has been brought to a state of sufficient effect; the varnish, &c. may then be cleaned off with turpentine.

Before laying the aquatinta ground, the plate must be thoroughly cleaned from dust and grease, with whiting and water, and properly dried; it is then placed in an inclined position in the pan, (a flat tin vessel for receiving the ground.) The ground is then poured from the bottle in which it is kept, upon the upper side of the plate, and which, from its inclined position, allows it to run down the surface till it is entirely covered. The plate is then turned round that the ground may run back; in a short time it begins to granulate, when the plate is to be placed almost horizontally, being still a little inclined, in order to admit of the superfluous ground running off. When the plate has become quite dry, and the ground sufficiently shaped, it is fixed and strengthened by holding it over a gentle fire, or a piece of lighted paper. The outline is then to be marked slightly with the etching-point, and the acquatinta process commences. On those parts of the plate required to be left quite white, the varnish No. 1. (the composition of which will be described below,) is correctly touched over with a hair-pencil, according to the form of the lights required, and the margin of the plate at the same time; when the varnish is hard, put on the bordering-wax, preparatory to the biting of the plate, and the aquafortis is poured on and allowed to remain a sufficient length of time, which, for the lightest shade of aquatinta, may not perhaps exceed two minutes; the next brightest lights are now touched with the varnish as before, (the plate having been previously washed with clean water, and dried with bellows;) the biting is then renewed, and continued for perhaps two minutes more; and by repeating this process, till every part receive its proper degree of strength, the effect of the whole is produced; but as this process gives but a very partial and imperfect imitation of an Indian ink drawing, for as hitherto directed it consists only of leaving out lights, and washing them down according to the effect required, there is still wanting, to complete the whole, a manner of representing sharp dark touches, as put on with a hair-pencil, such as in the foliage of trees seen against the sky, and which could not be left out in laying on the varnish, with due freedom, and perhaps not at all, without infinite labour in going round the part with it, and other parts where spirited execution of this kind is required. This sort of work is performed by means of what are called *bursting up compositions*, and are made, (as we shall presently describe,) of substances soluble in water, which are put all over the plates where those touches are to be put on, according to the order in which they may respectively occur, whether after the first, second, or third stage of the biting up. Where these dark touches are required then, the bursting up mixture is touched on, according to the form required; and when it has become sufficiently dry the whole of the plate is laid over with the stopping-up varnish; and when this last has also dried, the plate is floated with as much water as the bordering-wax will contain; having stood in this manner for fifteen minutes, or longer, the bursting-up composition will have become soft, and may be easily washed off with a hair-pencil gently applied to its surface, carrying along with it the stopping-up varnish which covered it, thus leaving the aquatinta ground in its original state, and ready to be again submitted to the aquafortis. In this manner all those dark touches are executed, and may be repeated, as required, whenever the stopping-up varnish has not been laid over the aquatinta ground.

We have thus endeavoured to give a view of the processes employed in this department of engraving; and before explaining the composition of the varnishes, we shall add a few further observations by way of illustration. Some artists execute their aquatinta plates with only one ground, but it is frequently necessary to put on a second, third, and even in large works a much greater number successively. When a plate requires, from the nature of the subject, a coarse and richly granulated aquatinta, it ought to be done with as few grounds as possible, as the more frequently the ground has been repeated the smaller will be the grain of the aquatinta, and also the more liable it will be to wear by the printing, and of course yield a smaller number of impressions. When the impression has been taken from the plate, and any parts are found to be too dark, they may be carefully lightened, and blended with the burnisher; those that are too light may be strengthened by laying on a new ground, proceeding as at first. When the aquatinta ground has been first laid, and become perfectly dry, it is usual, in order to make it work freely, and remove greasiness, to wash it with a little very weak aquafortis.

Aquatinta grounds are formed variously, and differ from each other in the smoothness and equality of their surfaces, or in the richness and configuration of their granulation.

1. *Resin-ground.*—Take one quart of the best double rectified spirits of wine, in a bottle, to which add ten ounces of common resin, previously pounded; this, when dissolved, is a very good ground, and is most commonly used. A variety of this ground may be formed, by pouring about the half of it into another bottle, after the resin is completely dissolved, and adding to it about a pint of spirits of wine.

2. *Burgundy-pitch ground.*—To one quart of spirits of wine, add ten ounces of Burgundy pitch; a variety of this ground is produced in the same manner as in that just mentioned.

3. *Mastic-ground.*—Four ounces of mastic dissolved in one ounce of spirits of wine. This should be made a month before using it.

4. *Copal-ground.*—To one quart of spirits of wine, add eight ounces of copal, dissolved in the sand-bath; it should be kept for a short time before being used, and it will resist the aquafortis better than any ground whatever.

5. *Gum-anime ground.*—Eight ounces of gum-anime and one quart of spirits of wine; if the spirits are good, the gum will be dissolved without the sand-bath.

6. *Frankincense ground.*—One quart of spirits of wine, to which add twelve ounces of frankincense; this, when entirely dissolved, may be varied by the proportion of spirit of wine added to it.

7. *Myrrh and frankincense ground.*—Dissolve six ounces of myrrh and the same quantity of frankincense in one quart of spirits of wine. This mixture takes some time to dissolve.

8. *Sandarac ground.*—Eight ounces of gum-sandarac added to one quart of spirits of wine.

9. *Benzoin ground.*—Eight ounces of gum-benzoin, and one quart of spirits of wine.

10. *Turpentine-varnish ground.*—To one-fourth of turpentine varnish, add three-fourths of spirits of wine.

The spirits for all these grounds must be of the best quality, and the resins must be all finely pulverised and put through a fine gauze sieve. The proportion of the spirits may be varied according to the quality of the ground required, and the granulation may be coarser in proportion as the quantity of resin is greater, and it may be finer when the spirit of wine is most abundant. Other and innumerable varieties of these may be produced by different mixtures of the grounds which we have given above, and these grounds are further varied by the state of the surface of the plate itself; thus if it has been polished with charcoal, or with the oil-rubber and *crocus martis* in one direction only, some grounds will run in straight lines from end to end without a break, others into short broken lines, others into the shape of a honeycomb, pentagons, &c. in infinite variety of configuration.

Dust grounds.—This process is performed by putting the resin, &c. on the plate in the form of a fine powder, without the intervention of any fluid. This may be done in various ways, but it is a work of considerable difficulty, and requiring great accuracy in its execution.

The powder most commonly in use consists of equal parts of asphaltum and fine resin pounded separately in a mortar, and reduced to a very fine powder. In order to form as perfect a mixture of them as possible, they are sifted in thin alternate layers over each other, till the whole is exhausted; this mixture is then passed through the same sieve to render the combination more complete; it is then fit for laying on the plate. Some artists use sandarac or good clear resin only, but of course finely pounded.

Applying the dust-ground.—The plate being rubbed with the oil-rubber and wiped with a piece of rag, as much of the grease of the oil will be left as will dim the plate; the powder is then sifted over it, and distributed with as much smoothness and equality on its surface as possible. The plate when sufficiently done is lifted up on its edge, and struck smartly on the back, in order to shake off the superfluous powder, and, by means of the grease left on its surface, as much is retained as will form the ground; the plate is then placed over a slow fire, or piece of lighted paper, in order to fix the ground. It is then ready for working on, and the process is conducted in every respect as directed in the spirit-of-wine grounds. As the smoothness or coarseness of the ground must obviously depend on the state of the powder, where a coarser ground is required a coarser dust must be used, separated by the sieve.

The ground may be laid on by having the dust tied up in a piece of fine lawn, and shaking it over the plate; it will be more equal the greater the elevation of the bag is from the plate.

If the plate be rubbed over with a mixture of water and whiting and a few drops of aquafortis, and then wiped off, it will receive the dust very readily, the plate not being allowed to dry completely; and when properly covered it may be lifted up and tapped on the back to remove the loose dust, and then fixed as formerly directed.

Madame Prestel's ground.—The method of laying the plate is to put the face uppermost in the bottom of a box of convenient size, and six inches deep, covered up with the lid; a hole is made at one end, and the dust-ground is put into a hairdresser's powder machine, the mouth of which is applied to the hole, and is then worked in the manner used by hairdressers till the plate is entirely covered; it is then taken out and the ground fixed. Madame Prestel's ground was made of finely pounded resin; and her works have been very much admired for the beauty and fineness of the grain, and for being excellent imitations of washed drawings.

The sulphur ground.—This process is a recent discovery, and is performed without the use of aquafortis. Sweet oil and fine vermilion are mixed together to a consistency fit for working with the hair-pencil. The subject to be executed is then painted on the copper with this mixture, and flower of sulphur is sifted over the plate as equally as possible;

when this has been sufficiently done, the plate is struck on the back in order to remove the sulphur from those parts of the plate not painted with the mixture; and when this has been thoroughly done, it is held over an even fire till the sulphur change its colour, and the part is sufficiently bit; the ground is then washed off with turpentine, and the process may be repeated till the whole be brought up to a state of proper finish.

Varnish for stopping-out.—This substance is formed by mixing half a pint of turpentine-varnish with somewhat more than a gill of spirits of turpentine, and this is added to as much fine lamp-black as will colour it and give it a body.

Composition for bursting up the varnish.—To half a pound of treacle in a glass bottle, add half an ounce of isinglass and eight ounces of gum-arabic; these are all put into a glass bottle with as much water as is sufficient to dissolve them; and to facilitate this, the mixture should be shaken twice a day at least. In using this substance, a little of it should be poured out into a cup, and a little lamp-black, burnt cork, or other pigment, finely ground, added to give it colour and body; if it be found too thick it may be diluted with water as required.

It may be made also as follows: half a pound of treacle, four ounces of white sugar-candy, and an ounce of gum-arabic dissolved in water.

Another composition for this purpose may be made of half a pound of the best moist sugar, an ounce and a half of isinglass, and one ounce of gum tragacanth; pour as much malt liquor of any kind as will make them liquid; the mixture may be then put on the fire to melt, and when this is effected it may be put into a bottle, and is fit for immediate use.

We have thus given such information with regard to aquatinta engraving as will be amply sufficient to enable the practitioner to perform the process; but being a work of much nicety, it requires considerable experience to execute it in the best manner. In our recipes we have given the formulas as prescribed by Mr Green of London, in his admirable treatise on this art, called "*The complete Aquatinter;*" and to those who desire more information on the subject, we recommend the perusal of the work itself. The third edition was printed in London 1810. Sometimes aquatintas have an etched outline, and in this case the etching must be done first, and when that is finished the aquatinta ground may be put on.

Mezzotinto.—This mode of engraving is performed by roughing the surface of the copperplate with a serrated instrument, in such a manner that, if an impression were taken from it in this state, it would give a deep black tint over all. The effect is given by scraping and burnishing the intended lights, and thus removing the dark ground; the smoother the surface of the copper is scraped, the lighter will the part be; and of course in the clear lights the plate will have recovered its original polish.

Sect. IX. *Of Wood-Engraving.*

Wood-engraving, as we have already shewn in the historical part of this treatise, is the most ancient, and the source whence printing and engraving have derived their origin. It is performed on blocks of pear-tree or box, and the surface on which the design is cut is on the transverse section of the wood. The design should be drawn with pen and Indian ink, and the wood cut away, leaving only the original surface where the lines are to appear. In large works like the blocks of Christopher Jegher, after Rubens, where much freedom and effect are required, every line to be engraved ought to be drawn with the pen and ink; but in small vignettes, and similar works this is not practicable. The tools employed in wood-engraving are chissels, gouges, and knives. Wood-cuts deliver the impression, not from the incision, as in copperplate engravings, but, like printing types, from the raised part of the block; and as the process of printing them, *i. e.* of throwing off the impressions, is the same in both, wood-cuts have always been an useful auxiliary to typography, whether for utility or ornament, in illustrating by figures or decorating with vignettes the printed text. The instruments used in wood-engraving must be kept very sharp, and require much dexterity and care in their management, particularly in cutting away the interstices between fine lines. The early masters, both of the German and Italian schools, whose wood-cuts represent drawings with a pen, produced the effect of cross-hatchings, which they executed with great freedom; how this was effected has been a subject of much speculation in our own time, and, as far as is at present known to us, must have been a work of infinite difficulty, although, from the profusion in which it appears in all their cuts, it must have been performed by some easy and expeditious means now lost. The reader will more readily appreciate the difficulty of this process, when he considers that the lines are left on the surface, and the interstices cut away, and that any representation of cross-hatching must be, if cut on one block, a work of infinite labour, and, even when performed with the greatest neatness, can hardly be supposed to possess much freedom. It has sometimes of late been successfully practised by using two blocks, one for the one course of lines and the other for the crossings; but this does not appear to have been the case with the ancient wood-cuts, as an examination of the impressions will lead us to conclude,—for those cuts executed on two blocks generally print with a different colour on the point where the lines intersect each other. It has been conjectured, that the original block might have been cut *en creux* on copper or other metal, and this might have formed a matrix or mould, from which a cast might have been obtained, by means of some vegetable putty, which would deliver the impressions by means of the printing-press. That such an effect might be produced, as in the stereotype plates, is very certain; and it appears to us that it is capable of very extensive utility in supplying the place of wood-cuts. But we can have no doubt that the blocks of the old masters did not consist of metal, but were either of wood, or of some vegetable composition, as many of the impressions that have come down to our time exhibit unequivocal proofs of the blocks having been worm-eaten.

Chiar' oscuro engraving is another mode of wood-cutting which was much practised by the old masters, but has been almost entirely superseded in the present time, by the more recent inventions of aquatinta and mezzotinto. It is a mode of imitating washed drawings, by means of separate blocks of wood, each representing a separate tint: The old chiar' oscuros were usually executed with three blocks, but sometimes with five. The first block consisted of the lightest tint, upon which were cut out those parts intended to be left entirely white; the second printed the darker tint, and the third gave the outline and darkest shadows; and if more blocks were used, they were applied to the different intermediate strengths of shadow. We have already in our history of engraving mentioned the process adopted by Mair and some of the early German masters; they executed their outline and deep shadows on copper, and gave the lightest tint only with the wooden block. We have also formerly noticed the recent application of this principle to printing in colours, in imitation of water-colour drawings, by Mr Savage of London. By this method a very fine effect is produced, the primitive colours requiring separate blocks; and, as in calico-printing, the labour may be economized by introducing these colours over each other, to produce the compound ones, the neutral tints, &c. This application of the art is at present only in embryo; but from the very beautiful specimens that Mr Savage has already sent abroad, it is evident that it possesses great capabilities, and may be found of very great advantage to the fine arts.

The work of the hammer, or opus mallei.—This mode of engraving is performed by means of punches, struck on the copper with the strokes of a hammer, from which it derives its name. It does not appear that this mode was at all practised by any artist except Janū Lutma, a contemporary of Rembrandt, who executed a few heads in it. His plates have a fine soft effect, and are of course in dots like stippling; these dots are, however, much larger, and have much of the tender tint that wooden blocks would give.

Sect. X. *Lithographic Printing.*

The art of delivering impressions from drawings made on stone, is a very recent invention; and the facility with which it may be executed, and the very numerous and economical purposes to which it may be applied, have made it an object of peculiar attention on the continent, where it has been carried to very great perfection, not only as a branch of the arts of design, but also as an expeditious method of producing any number of circular letters in the original hand-writing, and in the printing of music, plans, and the like. The general outline of this process is as follows: The design or writing is made on a calcareous stone, which is a powerful absorbent of water, and has also a strong attraction for resinous or oleaginous bodies, while the two substances, the oil and the water, mutually repel each other, and the resinous bodies have at the same time a strong affinity for other oily or greasy bodies. An ink, made with a greasy substance, is put on the block of stone, with a pen, or in whatever manner the work is intended to be executed; and when dry the stone is immersed in water, or moistened with a sponge. When sufficiently saturated, a printing ink (in which oil is an important ingredient) is put over the stone by means of printers' balls; the ink adheres to the lines or touches made with the pen, &c; and while the water repels the oily ink from the rest of the stone, moistened paper is applied to the surface, which being put into the printing-press delivers the impression according to the design.

The printing ink, having been once applied to the tracing on the stone, completely secures it from any injury that might arise from any future application of the nitric acid or water, by forming a crust over the tracing ink, which is otherwise in some degree soluble in water, and liable to be acted upon by acids. For this reason, it is obvious that no time should be lost after the tracing is completed to apply the ink, and that the stone should not be allowed to be damped so much as to soften or injure the tracing.

From this slight sketch the reader may be able to understand the leading principles and general theory of the lithographic process; and we shall now proceed to consider its various parts more in detail.

We have already said that the design to be printed must be drawn with a pen and the resinous ink upon the stone; as this is difficult from the hardness of its surface, and as the impression will be delivered in reverse, it is not so well calculated for *fac simile* writing, to which it is very frequently applied; it has therefore been generally found more convenient to make, with the resinous ink, the design or writing on a piece of paper, prepared so as to admit of being transferred to the stone; for this purpose, the paper should be prepared with a solution of gum-arabic, or alum, and when perfectly dry it is fit for use. When the design is finished, it is placed on the stone, which must be free from moisture, and moderately heated, and being subjected to the operation of the printing-press, the paper is found firmly attached to the stone; by damping on the back with a wet sponge, the ink is disengaged from the paper, and attaches itself to the stone; the paper is then removed cautiously, and the design is ready for printing, when a perfect *fac-simile* of the original is obtained. In transferring the design to the stone, some damp the paper with very hot water on the back before it is applied to it, taking care, however, that none come to the front to wet the stone, which ought to be previously heated, otherwise the impression will be but partially transferred. As any work executed with a pen and ink must be necessarily somewhat coarse, compared with what may be produced by means of etching, when this delicacy of touch is required a different method must be adopted; instead of drawing the design on paper, it must be done directly on the stone.

The stone being covered with a solution of gum-arabic, coloured with lamp-black, and being perfectly dry, the design is carefully wrought up to the effect required by means of etching-needles of different thicknesses, according to the breadth of the several lines. In this process it will be sufficient to scratch off the coating of gum from the stone, without making any incision into it; and in this respect it bears considerable analogy to the process of etching, as the gum in the one, and the etching-ground in the other, are employed respectively in defending the stone or copperplate from the action of the substances to which they are subjected, namely, in lithography to the action of oil, in etching to aquafortis. The resinous ink is then rubbed strongly over the stone, which is defended from it by the gum on every part except where the scratches have been made; the stone is then washed with water applied with a sponge; the ground of gum and lamp-black is washed off, and the resinous ink adheres only where the etching is put.

If, instead of the resinous ink which we have mentioned, the scratches are filled up with copal varnish, the design will be infinitely more durable and less liable to injury; the copal varnish being allowed to dry, becomes very hard, and acquires the faculty of resisting alkalies, weak acids, oil of turpentine, and spirit of wine, so that, during the process of printing, the stone may be cleaned by any of these substances without difficulty, or the risk of injuring the design. The copal varnish is, for this reason, best suited for purposes of lithography, if treated with a preparation of gum; but being thick and not sufficiently fluid, it cannot be used with a pen.

Designs in imitation of crayons or chalk may also be executed in the lithographic manner. For this purpose the resinous ink should be made up into crayons, and the design executed with all its finishing on the stone; and, preparatory to printing, it is to be treated in the same manner as the other modes of it. The preparation of the ink and crayons we shall afterwards explain.

When drawings, such as ornaments and the like, are required to be executed on a dark ground, leaving the figure white, the design may be drawn on the stone with a solution of gum-arabic coloured with lamp-black, which being allowed to dry, the whole stone is rubbed over with lintseed oil. The gum is then washed off, and the resinous ink is applied to the stone with the dabber, which will adhere only to the parts where the oil has been absorbed; and the design having been defended from the ink by means of the gum, remains untouched by it. It is then ready for printing, in the same manner as in the other methods of lithography.

When the design in any of these ways has been drawn on the stone, nitric acid of a moderate strength, so as not to excite an effervescence, is to be washed over it, in order to render it more absorbent; it is then well washed with water, and is ready for printing. In order more effectually to secure the stone from the printing-ink on those parts where no impression is intended, that is to say, where no design is drawn, though not absolutely necessary, it will be attended with considerable advantage to wash the stone at the beginning with a solution of gum-arabic, which forms a sort of varnish over it, and is a further preventive of injury from the printing-ink. During the process of printing, the stone is placed on the printing-press in the same manner as the form with the types, and the paper moistened; and to secure it from injury by pressure, it should be put in a box of fine sand, and the rest conducted as in letter-press printing. As moisture in the stone is essential to lithography, before each impression it must be well moistened with a large wet sponge, and if it be a subject which requires much time to charge the stone with the printing-ink, it is kept humid with more ease by adding to the water a solution of salt. The printing-ink is put on with the common dabber or printing-ball, and should be applied carefully and not too thick, otherwise the lines will print broader than in the design, by its spreading over the stone by the pressure of the press.

Limestone has been found, of all others, best suited for the purposes of lithography. It ought to be compact and fine-grained, in order to receive the delicate lines and touches that must occur in the design. When natural stones are not to be had, a good substitute may be had in plates of fine potters' clay baked and unglazed, but which must be of such fineness of grain as to be capable of taking the necessary degree of polish. Blocks may be also formed of plaster of Paris, saturated with water, in which a small portion of common glue has been dissolved.

The stones must be of an equal thickness and level surface, by rubbing them with finely pounded and sifted sand and water till they are smooth; they are then to receive the last polish with fine-grained pumice-stone. The stone is then washed with a little weak nitric acid, in order to render it more absorbent. For crayon-drawing the stone ought to be rather rough, in order to receive and retain the traces of the design; for this purpose it ought to be rubbed with a flat stone, and finely pounded sandstone, till it assume a rough granulated appearance; the nitric acid is not applied, as in the other method, till after the design has been finished.

The resinous ink employed for tracing or drawing the design, is made up as follows: Five parts of gum-lac, one of grease, one of finely pounded mastic, one of pure caustic soda, and as much lamp-black as is sufficient to colour it, are reduced into a fluid state by being put into a glazed earthen pot and melted over the fire, and diluted to a proper consistency with distilled or rain water.

The printing ink for the impressions is composed of one part grease or coarse soap, four parts white-wax, one part gum-lac, and one part lamp-black bruised and very dry. In mixing these ingredients, the grease or soap is cut in small pieces and put on a strong fire in an iron pot; this being well heated, the wax, also in small pieces, is added, and stirring it about, it is then set fire to with a match, and while burning the gum is added; and, when dissolved, extinguish the flame by covering up the pot, and while the mixture is boiling add the lamp-black, still stirring it till the whole is completely incorporated; it is then taken off the fire, and poured out on a plate of iron to cool. It becomes then completely solid, and may be preserved in cakes; and, when wanted for use, it will be cut into pieces and dissolved in spirit of turpentine or lintseed-oil to a due consistency; it must not be very thin, as the lines will then be unequal and weak in their effect.

The lithographic crayons are formed nearly in the same manner as the ink. Two parts of tallow or soap cut very small, are put into an iron pot and heated till it begin to burn; one part and a half of gum-lac is then thrown into it; when this is dissolved, the flame is extinguished by putting on the cover; two parts of virgin-wax are then added, and when the whole is well incorporated the lamp-black is added in quantity sufficient to colour it; it must be allowed to cool slowly, and poured out while yet in a soft fluid state upon a plate of iron or slab of stone, and before becoming hard it must be pressed strongly, in order to make it quite solid by expelling the air bubbles, and cut into narrow pieces for crayons. The different degrees of hardness or softness in the crayons, that may be required for different kinds of work, may be given in making the crayons, by the addition of a greater proportion of wax and resin for the hard ones, and of tallow or soap for the soft crayons.

Another composition for crayons has been sometimes used; it is as follows: Three parts white wax, three parts white soap, one part gum-lac, and one part mastic, coloured with a sufficient quantity of lamp-black, prepared as above described; if too hard, the quantity of resin to be diminished, and if too soft of the soap. In using them, they ought to be frequently changed, as they soon become soft in the point by working.

We have thus given a view of the various processes used in lithography; but as conducting a work of this kind is attended with considerable difficulty, when neatness, precision, and the perfection of which it is susceptible are required, we shall add a few general observations, which may tend to render success more complete.

One of the greatest inconveniences to which the lithographic manner is subject, arises from the stones becoming dirty from grease or ink adhering to them, while the difficulty of cleaning them, and at the same time preserving the design uninjured, are obstacles hardly to be surmounted without infinite care and attention. The best preventive is to cover the surface of the stone with a solution of gum-arabic; but when this is not sufficient, and the stone has become much soiled, it may be cleaned by the following process: Mix two parts of olive-oil, two parts oil of turpentine, and three parts of water; the mixture is strongly shaken in a bottle till it come to a lather; the stone being previously well soaked in water, in order to prevent the oil from combining with the greasy part of the ink, this lather is applied rapidly with a sponge over its whole surface; it is then washed off with clean water, and the stone resumes its original purity. During this process the stone becomes quite white, and even the design is not visible for a time; but being well washed, and again charged with the ink by means of the dabbers, the lines re-appear as sharp as at first. The stone then gets a thin coating of gum-arabic, which will defend it from further injury. We have already said, (and it may be again enforced in this place,) that the stone must be carefully washed with water previous to each impression, and it may be also occasionally moistened with gum water; and if, by any chance, notwithstanding every care, spots should occur, they must be instantly taken off as above directed; and if the ink still shew a tendency to adhere to the stone, it may perhaps be prevented by washing it with a little diluted nitric acid, applied with a sponge, as already directed. All those substances require different sponges for each, as it is obviously necessary that they should be kept as pure and as much separate as possible. In printing impressions from stone, it will be found that the block at first does not deliver freely till after a dozen impressions have been taken, which seems to arise from the tracing not having yet acquired sufficient thickness and *relievo* from the surface of the stone; and, in this early stage of the printing, the stone must be charged with the ink very sparingly and gradually, otherwise it gives a thickness and coarseness to the lines which are highly injurious to the effect of the work.

The ink should be poured on a piece of polished hard wood, and spread out with a muller into a thin and equal layer; it is then taken up sparingly with the dabber, and extended over its surface by beating it forcibly and repeatedly with another dabber till it be thinly and equally distributed; it is then applied smartly to the stone and beat in with considerable force till every part of the design be charged with the ink; and if it be a subject of much delicacy, requiring care to cover the fine lines, in order to keep the stone moist it should be carefully passed over with the wet sponge as required.

For lithographic impressions, thick paper is preferable; and, when sufficiently moistened, it becomes flexible enough to be applied correctly to all the parts of the stone.

This art, which promises to be of so much importance to society, has been little practised in England, except for the plans and maps from the Quartermaster-general's Office at the *Horse-Guards*; but it has been more recently applied to purposes more intimately connected with the fine arts, by Mr Ackermann of London, who has published several drawing-books, &c. which give sufficient evidence of its utility. We also refer the reader to *Journal des Scavans* for 1812, where he will find two specimens which display the very admirable manner in which it may be applied to the production of all the delicacy and neatness of effect of a highly finished etching.

PART IV. PERSPECTIVE.

Linear Perspective is the art of delineating, according to mathematical principles, every species of visible objects in their true figure and proportion, as they would appear to the eye of a spectator when viewed from any given point.

As perspective is the grammar of design, it is indispensable in every department of drawing. It is an important assistant to the painter in determining the figure of his objects, their reflections in water or other bright surfaces, and the form of the shadows as projected from the sun or other luminary. It is essential to the engraver, in regulating the courses of his lines, in the finishing of his work. And to the architect, by means of projections from his plans and elevations, it is of the utmost importance, by exhibiting to him, while yet existing only in his sketch, the true appearance of his proposed edifice, as it would be seen from any given point of view; and thus enabling him to supply defects, and to adapt the several parts of his work to each other.

Sect. I. *Theory of Perspective.*

Objects are rendered visible by the rays of light passing from every part of them to the eye, to which they converge in the form of a cone or pyramid. If this be cut across at any point between the object and the observer, whose eye is supposed to be at the apex of the pyramid or cone, the section will give a true representation of the figure, as seen from that point.

A picture, or perspective design, is supposed to be a transparent plane, which cuts the rays of light as they pass from the original object beyond it to the spectator's eye.

Fig. 1. Plate 57. Let A B G D be an original object, lying on the ground; E the point of sight, or place of the eye of the spectator; the lines A E, B E, G E, D E, the rays of light passing in right lines from the several points of it to the spectator's eye, form the the pyramid spoken of above. M I is the transparent plane cutting it; and this section gives the true appearance that such an object would have to a spectator viewing it from that point; the points, a, b, g, d, on the transparent plane or section, representing respectively the corresponding points of the original figure A B G D. It will be obvious, that if the relation between the figure and the spectator be altered, by changing the position of either, the pyramid of rays will assume a different form, and, of course, the section on the transparent plane, that is, its perspective representation, will also be different.

From this, the following axiom may be deduced; namely, that the perspective of any object must present the same configuration as would be produced by the section of the rays passing from any original object (actually placed in such a given situation) to the eye of the spectator; and that this point of convergence is the only place where the perspective representation of any object can be viewed, so as to give the full effect of deception of which it is susceptible. This point, or place of the spectator's eye, is called the point of sight.

If a line, E C, be drawn perpendicularly to the plane of the picture M E, from the point of sight E, the point C is called the centre of the picture, and is sometimes also called the point of sight; and the line E C is called the direct ray of vision.

The distance from E to C, that is, the distance between the picture and the spectator, is called the distance of the picture.

The original object, A B G D, is the real object proposed to be represented; and the original plane, or ground-plane, is that on which it is placed.

The line, I K, where the bottom of the picture intersects the ground plane, is called the ground line.

A line drawn parallel to the horizon, as the line H L, through the point C, is called the horizontal line.

The vanishing line of an original plane or line, is a right line in the picture, formed by its intersection with an imaginary plane passing through the eye parallel to the original one; and on this line the vanishing point of that plane will be found: thus L H, Fig. 1. is the vanishing line of the original plane A B G D; and D M, Fig. 18. is the vanishing line of the plane a d c e.

The vanishing point of an original plane, is that point where a line, passing through the eye of the spectator, parallel to that original plane, cuts the picture; thus the point C, Fig. 1. is the vanishing point of the lines a b, g d, which respectively represent original lines A B, G D.

As the figures of all objects are contained under lines bounded by points, that is, under lines terminating in different places, it is evident that the whole art of drawing in perspective consists in finding the situation of all lines lying on the perspective plane, and cutting those lines in any proportion, according to the lengths required. Curves are no exception to this observation, since they are drawn by fixing a sufficient number of points in right lines, and joining them with a steady hand.

In order to simplify, as much as possible, the principles of this art, we have endeavoured to avoid encumbering the examples with too strict an application to any particular species of objects. The reader will therefore recollect, that whatever the object may be which he proposes to delineate, the perspective appearance of the several lines of which it may be composed, will be found by attending to the rules laid down for representing the different classes of lines to which they belong, that is to say, whether its ground plan consists of lines perpendicular, parallel, or oblique to the ground line, and whether its elevations consist of lines perpendicular to the horizon, or of inclined planes, or a combination of both; and, accordingly, whether the design represent natural or artificial objects, architecture or mechanics, on a large or a small scale, they will still be conducted on the same principle.

Lines or planes in perspective may be reduced to the following classes:—

First, lines that either lie on the ground or are parallel to the horizon: Second, lines that are vertical, or perpendicular to the horizon, and parallel to the plane of the picture: And, third, inclined planes.

I. Lines lying on the ground may be either, 1. parallel to the ground line; 2. perpendicular; or, 3. oblique. 1. Lines or planes that are parallel to the ground line undergo no change in their perspective figure, but are only longer or shorter according to their distance from the point of sight. 2. Such lines as are perpendicular to the ground line always converge to the point of sight,—we mean here the centre of the picture. 3. Lines oblique to the ground line converge to a point on the horizontal line, which will be regulated by the degree of the angle of its obliquity. II. Vertical lines, being parallel to the plane of the picture, undergo no other change than being magnified or diminished according to their distance from the spectator. III. Inclined planes converge to a point either above or below the horizontal line, which is indicated by the angle of their inclination, and the direction in which they may stand with regard to the spectator.

All lines that are not parallel to the picture, converge to some vanishing point; and, accordingly, when two or more such lines occur, the distance between them will be diminished in proportion as they are removed from the spectator's eye.

All lines that are parallel to each other, but not parallel to the ground line, converge to the same vanishing point.

In order to render more obvious what we have just said, we shall illustrate it by a few examples. Let Fig. 2. be the ground plan, representing the geometrical situation or seat on the ground plane of the several parts of the diagram, Fig. 1. The square A B C D, Fig. 2. represents the original square A B G D of Fig. 1.; the line I K, the seat of the transparent plane or picture E M I K and E, the seat of the spectator E. Now, lines lying flat on the ground are either parallel to the ground line, as A C, B D, are to I K; or perpendicular to the ground line, as A B, C D, are to I K; or oblique to the ground line, as C B is to I K; and the degree of obliquity may be more or less as required. In this case, the line C B subtends with the ground line an angle of 45 degrees.

Lines that are parallel to the ground line, as A G, B D, Fig. 1. are represented in perspective by lines also parallel to the ground line, as a g, b d; but they become shorter the greater the distance they are seen at, as a g is shorter than b d, being the whole length of A B, Fig. 2. farther removed from the spectator E than the line B D in the original plane.

Lines that are perpendicular to the ground line, as A B, C D, Fig. 2. always converge in their perspective representation to the centre of the picture, as b a, d g, Fig. 1. to the point C on the horizontal line H L.

Lines that lie obliquely with respect to the ground line, have their vanishing point on the horizontal line; and this point is found by drawing a line from the eye of the spectator parallel to the original line till it cut the plane of the picture.

Let B C, Fig. 2. be an original line lying on the ground, subtending an angle of 45 degrees with the ground line I K, to which it is produced, and intersecting it at e,—a line drawn from E, the seat of the spectator, parallel to the original line B C, will cut the ground line I K, and the point I will be the seat on the ground of the vanishing point for the line B C, and for all lines that are parallel to it; that is to say, that the vanishing point of the line B C will be found upon the horizontal line, perpendicularly over the point I. This will be further illustrated by an inspection of Fig. 1.: G B is the original line, E H the line drawn from E, the spectator's eye, parallel to it, the line b g on the picture is its perspective representation, and is seen running to the point H, as indicated by the occult line *b g* H.

Sect. II. *Of the Preparation of the Picture.*

Any size being given for the picture, its lower boundary or base line, A B, Fig. 3. will represent the ground line I K, Fig. 1. The point C is then marked in the centre of the picture, reckoning from side to side, and its height is determined by the nature of the subject, and the height at which it is intended to be viewed, always keeping in view that the centre of the picture is found by drawing a line from the eye of the spectator, perpendicular to the plane of the picture, till it intersect it, as shewn in Figs. 1. and 2. At C a line is drawn parallel to the ground line; this is called the horizontal line, and is the line on which the vanishing points of all horizontal lines are found, as at b C, d C, Fig. 1. Perpendicular to the ground line, through the point C, the line N C O is drawn, and on the lines H L, C O, the points H, O, L, are marked at a distance from C, equal to the supposed *distance of the picture*, or distance from E, the place of the spectator, (Fig. 1.) to the nearest part of the plane of the picture. The points H, O, L, are called points of distance, and their chief use is to cut off, at any given distance, points upon lines already obtained, but as yet of indefinite lengths.

As in every picture this preparation must be made, in our subsequent figures these lines and points will be respectively represented by the same letters, and we shall not occupy space by repeating this part of the process.

As we are anxious to be clearly understood on this point, and as some of our readers may not have followed us perfectly through the intricacies of the subject, we shall hazard the reproach of tediousness, and trouble the reader with another diagram. Let X, Fig. 4. be an original ground plane, containing the lines A A A A, lying perpendicularly to the ground line the lines B B, intersecting them at right angles, and of course parallel to the said ground line, and respectively analogous to the lines A B, G D, and A G, B D, Fig. 1.; let the plane Y which rises perpendicular to the plane X be placed in that direction, it will represent the transparent plane or picture E M I K of Fig. 1. The plane Z will also be set up parallel to the plane Y, and will represent the plane of the spectator, and the point V the point of sight or spectator's eye. The centre of the picture will be found by supposing a line drawn from the spectator's eye at V on the plane Z perpendicular to its surface, till it cut the plane Y at C; this will be the centre of the picture, and will give the height of the horizontal line, which will now be drawn through C parallel to the ground line; the distance between the planes Y and Z, that is, between the spectator's eye and the picture, will give the distance at which the points of distance H, O, L, will be placed from C, the centre of the picture.

Sect. III. *Lines Perpendicular to the Ground Line.*

Let it be required to give, on the plane Y, a perspective projection of the parallel lines A A A A A, Fig. 4. lying on the original plane X, perpendicular to the ground line I K.

The points a a d a a, at which they intersect the ground line of the picture IK, on the plane Y, will give their relative situations and distances; the lines a C, a C, d C, a C, a C, will then be drawn to C, the centre of the picture, and will give, of an indefinite length, their perspective representation as they would appear to a spectator standing at Z, V being the height of his eye.

In this example, the ground plane, X, and the perspective plane or picture being attached together, the mere intersection of the original lines A a, A a, A d, Aa, Aa, with the ground line IK, is sufficient to indicate their respective places along that line; but when the ground line and perspective plane are detached, as is most usually the case in practice, their places are found by marking on the ground line the place of the point at or nearest the centre, as may be required, and regulating the places of the other points by it; thus the point d, the intersection of the line Ad with the ground line, stands immediately in the centre between its two extreme points, and of course perpendicularly under the centre of the picture C; it will accordingly be placed on that point, and the remaining points, a a, a a, on each side, will be measured accurately from d, according to their geometrical distances from each other on the ground plane X.

The lines a C, a C, d C, a C, a C, on the plane Y, being carried from their respective places on the ground line to C, the centre of the picture, give the perspective representation of the original lines Aa, Aa, Ad, Aa, Aa, on the plane X, infinitely produced. Let it be required to mark points upon them at given distances, as b and c, on the same plane, and thus cut off portions of them into certain given lengths,—the distance from the ground IK, of the points b and c, will be marked along it at *b* and *c*, with the radius a b, a c, on the perspective plane Y, and from the points b and c, the lines *b* L, *c* L, will be drawn to L, the point of distance, and their intersection with the line a b c C, will give the points b and c, required, and consequently cut the line a b c C, into the length given; and in this manner the line C c b *a*, may be divided into any number of lengths, or parts, setting off along the ground, from its root or intersection with the ground line, the points or distances required, and intersecting them by lines drawn from those points or distances to the point of distance L. If, instead of the line C c b *a*, it were required to make those points on any other of those lines converging to the centre of the picture C, as for example d C, the distances required may be set off along the ground line from the point d, as d a and d a a, and carried to the point of distance L, as already shewn, and the intersection will give the points required, as at e and f; or, if it be more convenient, those points may be found by transferring them from the points *c b*, by a line from c and b drawn parallel to the ground, the intersection of which with the line d C will give the points required.

We have, in the foregoing figure, for sake of more strict analogy with Fig. 1. and 2. (which were intended in some measure to illustrate the theory of the art,) placed the ground plan in its natural situation behind the picture or perspective plane, but the results are the same, and it is considerably more convenient in practice to place the ground plan of the figure in front of the picture below the ground line; which arrangement we shall adopt in the figures that are to follow. The ground plan, although it must always be understood, need not be at all times drawn, if the operator can carry in his mind the proportions and magnitudes of the several parts of the figure, as the perspective figures may be very accurately found by marking along the ground line the places of the several points and distance of the objects, and carrying them forward to their vanishing points, and intersecting them by the points of distance, without having the plan before him, thus finding their distance from the ground line; thus, if it be required to draw the perspective appearance of any number of lines perpendicular to the ground line at a given distance, *a a d a a*, from each other, it will be found by carrying them to the point C; and if points are to be marked on those lines at given distances from the ground line, they will be marked upon the ground line, and carried to the point of distance, and their intersection will give the points required.

Sect. IV. *Of Lines Parallel to the Ground Line.*

We have already said, that lines and planes parallel to the ground line undergo no change in their perspective figure, but are only reduced in magnitude according to their distance from the ground line.

Let the lines b e c f, in the ground plane X, Fig. 4. be lines parallel to the ground line, and removed from it to the distance of *a* b *a* c respectively, it is required to find their perspective situation on the plane Y. This proposition may be very well exemplified on Fig. 4. by considering the lines c f, b e, as the lines required, and the lines A c b *a*, A f e *a*, as the occult lines, the reverse of which was the case in the former example; but in order to avoid confusion, we shall take this example by itself at Fig. 5; and the reader may trace the analogy between those two figures, by comparing them with each other. The picture is prepared as already described at Fig. 3; C the centre of the picture; H L the points of distance on the horizontal line; I K the ground line. It is required to give a perspective representation of the lines B e C *f*; the occult lines C B *a*, *f e a*, terminating the original lines at each end, are produced to the ground line at *a*, *a*; these being lines perpendicular to the ground line, are represented in an infinite length by converging to the point C; the points *b* and *c* will then be found on the line *a* C, by taking their distance from the ground line at *a*, and marking it along the ground line at b and c; the lines b L, c L, will be drawn to the point of distance L, and their intersection with C *a*, at *b* and *c*, will give the points required: We have thus found the points terminating one end of each of the lines given, and as they are parallel to the ground line their direction will be found by drawing them from those points parallel to the ground line, till they intersect the line a C, at e and f, by which their other terminations will be found, and the figure required will then be completed.

In this and the former figures, we have made use of only one point of distance, L; but the point H, on the opposite end of the horizontal line, may be used indifferently with this, and the result will be equally correct.

The picture, Fig. 6. being prepared as in the preceding examples, it is required to find the perspective place of the points B and c upon the picture: A C is the occult line on which the points required are to be placed; the distances A B, A c, as in Fig. 5. were marked along the ground line at b c, and from thence the lines b L, c L, intersecting the line a C, going to the point of distance L, give the points required. The distance a b, a c, might be placed at 1, 2, on the other side of the point a, and from thence carried to the point of distance H, and they will still intersect the line *a* C at the same points *b* and *c*. The distance of any point, such as b c on the line *a* C, may also be found by intersecting that line by lines from B and c, on the ground plan, to the point of distance O, as B O, c O, which intersect the line A C on the points *b* and *c*, and thus give the points required. Although the points of distance H L, on the horizontal line, are most generally used for ascertaining the situation of points on lines perpendicular to the ground line, the point of distance O, when convenience suits, will answer equally well, and yield the same results.

The analogy between this and the former method will be quite obvious if we turn the picture, and consider C O the horizontal line, C being still its centre, O the point of distance. The line A B *c* will now be a portion of the ground line, analogous to a, 1, 2, on the line I K, Fig 6. in the former example, and O will stand in the same relation to the other points and lines as the point of distance H in the former examples; and consequently the lines *b* O, c O, Fig. 7. will do the same office as 1 H, 2 H, Fig. 6.

This principle will be farther confirmed and brought home to the mind of the reader, if he considers, that, in looking at objects in nature, no difference exists in their relations with each other, whether he views them with his head in its usual vertical position, or whether he turn it on its axis laterally to a horizontal position.

From what we have already shewn, the reader will perceive that the position and form of any object whatsoever, whether polygon, circle, ellipsis, &c. lying on the ground, may be found by ascertaining the places of the points that terminate their right lines; and in curves of whatever description, by obtaining a sufficient number of insulated points along their length, and joining them with a steady hand.

Let the points 3, 4, 5, 6, 7, Fig. 7. represent the ground plan of an irregular figure, one part of which is bounded by the segment of a circle at 3, 4, 5, 6, 7, and the remainder by right lines at 3 8, 8 7; the several points will be found on the picture in the same manner as the points b c, Fig. 6. by producing the points in lines perpendicular to the ground line, setting off their respective distances from the ground line, and intersecting them separately by their lines running to the point of distance. Thus the perspective situation of the point 3 is found, by producing it to the ground line in a direction perpendicular to it, as 3 *f*; its distance from the ground line will be marked with the radius 3 f, along the ground line at d; the line dH is carried to the point of distance H, and its intersection with the line *f* C, gives the point required. In like manner, the point 4 will be found by drawing the line 4 *e* perpendicular to the ground line, and the distance of 4 from *e*, that is, its distance from the ground line, will be set off at *g*, from *e*, with the radius 4 *e*, as indicated by the arc 4 *g*; the intersection of the lines *g* H with *e* C gives the point required. We need not repeat the process as applied to the rest, they will all be carried to the ground line on which their distances will be marked, as h *k* for 5, *i n* for 7, *l m* for 6, and o p for 8, as indicated by their several arcs; the lines *h* C, *i* C, *l* C, will then be drawn to the point C, and the intersections of the lines *k* H, *n* H, *m* H, will give their places on the picture, they will then be united by lines to complete the picture; 3 8, 7 8, are right lines, and will be drawn accordingly. The line 3, 4, 5, 6, 7, being the segment of a circle, will be drawn with a steady hand, as its situation on the perspective plane directs, when the figures will be completed. To avoid confusion by unnecessarily multiplying the letters of reference, they are here omitted in the perspective figure.

Sect. V. *Lines Oblique to the Ground Line.*

The theory of this class of lines we have already noticed at G B, Fig. 1. and CB Fig. 2. We shall now give an example of its application to practice.

Let A B, Fig. 8. be a line lying oblique to the ground line, the degree of its obliquity will be found by drawing a line perpendicular to the ground line on the plan, and measuring with the protractor the angle subtended by A B, on that line, which in this case is 20 degrees; from the point of distance O, a line will be drawn subtending an angle of 20 degrees, that is, equal to the angle of the original figure; this will be produced till it intersect the horizontal line at E, and the point E will be the vanishing point for the line A B, and all lines parallel to it. The line A B will now be produced to the ground line in its original direction, as at *a*, and the line *a* E will be drawn to the vanishing point E, which will give the representation of the original line A B, of an infinite length.

If it be required to cut off any given part, as the portion A B of the original line, a point of distance must be found, which will be of the same use as the points H and L in the former figures. Upon the point E, with the radius E O, make an arc cutting the horizontal line at F, this will be the point of distance for the vanishing point E. The distance *a* c, *a* b, will be marked upon the ground line with the radii *b* B, *a* A; the lines *b* F, *c* F, will then be drawn to the point of distance F, and their points of intersection with the line *a* E, will give *b*, *c*, the points required; and the portion of the line *a* E, contained between *c* and *b*, will be the perspective representation of the original line A B.

If it be required to subdivide the line A B into any greater number of parts, the same process will still be followed. In this example it is divided into four equal parts; but an examination of the figure will be sufficient, without further explanation.

In the same manner, every different vanishing point will have a separate point of distance.

Let Fig. 9. be prepared in the same manner as the preceding example; the line A B is placed for the sake of varying the figure at an angle of 70 degrees, with the line O D; B G is added perpendicular, that is, at right angles to it, and consequently subtending with the line O D, an angle of 20 degrees; upon the principle laid down in the last example, the vanishing points of the two lines will be found by drawing from the point O, to the horizontal line, lines parallel to the originals; thus O P being drawn from O, parallel to B G, gives P the vanishing point of the line B G. In like manner, O E is drawn parallel to A B, and where E intersects the horizontal line the vanishing point of the line A B, and of all lines parallel to it, will be found. The line A B on the plan is produced till it intersect the ground line, as at *a*; and from *a* to E, the line *a* E is drawn, which gives the perspective representation of the original line A B *a*, of an infinite length; the points A B will be found as given in the former example, Fig. 8. viz. by marking their distances along the ground line, from the point *a*, as indicated by the arcs B 1, A 2; from the points on the ground line, 1, 2, the lines 1 F, 2 F, are drawn to F, the point of distance of the vanishing point E, and their intersection with the line *a* E gives the points a, *b*, representing respectively the original points A B, according to their true perspective distance from the ground line and from one another. In the same manner, the perspective representation of the original line B G will be found. The line B G is produced to the ground line at b, and the arcs B 3, G 4, are drawn to the ground line with the radii b B, b G; from the point b, the line b P is drawn to P, its vanishing point, which gives the perspective situation of the original line B G, of an infinite length; the lines 3 M, 4 M, are drawn to M, the point of distance of the vanishing point P, and the intersection of these two lines with the line b P, at the points *b* 5, gives respectively the situation of the original points B and G; and as the line *b* 5, represents the original line B G, and the line *b* a the original line *B* A, forming two sides of a square, the angle a *b* 5, will represent the original angle A B G. If it be required to add other two sides in order to complete the square, each line will be carried from the point given, to the vanishing point proper to it, and all its parallels; thus, the line A N being parallel to B G, will have its perspective representation converging to the same finishing point, namely, to the point P; and accordingly, the line a P will give the direction of that line of indefinite length; E is the vanishing point for the original line A B; and N G being parallel to it, its perspective representation will also be carried to the same point; that is, 5 E will be drawn to E, and the intersection of the line 5 E, with a P, gives the point 6, representing the angle N of the original figure; consequently the line a 6, will represent the line A N; and 5 6, the line G N; and the angle a 6 5, the original angle A N G.

This method of drawing, according to a given measurement, lines that are oblique to the ground, by means of their several points of distance, we have explained first, as bearing a closer analogy with the processes adopted in the two other classes of lines, (those perpendicular and parallel to the ground-lines); in practice, however, being unnecessarily circuitous and prolix, from the great number of points, lines, and distances which must be found, we shall now exhibit a method equally correct, infinitely more expeditious, and much more convenient for general practice.

The picture, Fig. 10. is prepared as in Fig. 9. The original square A B G N, the same as before. From the point of distance O, the line OP is drawn subtending with O C an angle of 40 degrees; that is, it is drawn from O parallel to the original line B G; its intersection with the horizontal line at P, gives the vanishing point of the line B G, and also of A N, which is parallel to it. From the point O, the line O E will be drawn parallel to A B, that is, subtending an angle of 50°. The point E will be the vanishing point of A B, and of all lines parallel to it, and consequently of G N. The lines A B, G N, G B, N A, are produced to the ground line at *a*, e, b, and c; and from *a* and e, the lines *a* E, e E, are drawn, and give representations of the original lines A B, N G, infinitely produced: In like manner, b P, c P, are drawn to P, representing in the same way the original lines B G, A N, and the intersections of those lines with each other at a *b* g *n*, will give the figure required,—and an inspection of it will be sufficient withont farther explanation.

Before proceeding to the perspective of elevations, or objects parallel to the perspective plane, we shall, by way of appendix, add a few diagrams, illustrative of the extensive application of the principles which we have already laid down.

Sect. VI. *Of the Circle.*

Let A B N G, Fig. 11. be the circle given, inclosed within a square, as V X Y Z; diagonal lines are drawn from the opposite angles, as V Y, X Z; the circle touches the square at the points A B N G, and it is intersected by the diagonal lines at the points *e*, *f*, *g*, *h*; from these points of intersection the lines *c h*, f g, are drawn across the square, parallel to the ground line, and *e f*, *h* g, perpendicular to it. As we have already sufficiently exemplified those two classes of lines in Figs. 4. and 5. we need not repeat in detail the steps taken to find out the perspective situation of points obtained by the intersection of such lines; but it is obvious that if these lines are found on the picture, their intersection will give the points required.

The distances of the several points of the original figure as measured from the ground line, are here transferred from their proper lines to the line X Y, that is, the point A to X, and N to Y; and the points *h e*, *g f*, to the same line; their perspective places will be found on the line *x* C, as indicated by the points marked on that line, and the points required will be found on the picture by transferring them to the several lines perpendicular to the ground line on which they are to be marked: Thus the perspective representation of the line A N is found on the line 4 C, the distance from the ground line of the points A and N, are transferred to the line X Y, viz. A at X, and N at Y; now as x and y represent respectively, on the perspective plane, the original points X and Y, and as the line 4 C represents the original line A N, (of an infinite length,) lines drawn parallel to the ground line from y and x will give corresponding points in the picture; in like manner the other points will be transferred to their proper lines, namely, those which represent *g* and *h* to 5 C, *e* and *f* to 3 C, and B to 6 C. As we conceive that we have rendered this process sufficiently clear, to those who have followed us in the explanation of the principles which we have already laid down, it will be unnecessary to crowd the figure with farther references. The several points being thus found, the line circumscribing the circle will be drawn with a steady hand from one to the other. We have given this method first, as being founded strictly on the same principles as we have adopted in the former figures; but the process may be considerably shortened, in the following manner, whereby all the arcs which intersect the ground line between the points x and K, may be dispensed with, except the arc X 7, which gives the distance of the figure from the ground line.

The original plane being given as before, the lines 6 C, 5 C, 4 C, 3 C, will be found in the line x C; its distance X x is set along the ground line at 7; the line 7 H is drawn to H, the point of distance; its intersection with x C gives the point x required. As, in the original figure, the diagonal line X Z intersects the lines $e f$, $h g$, at the same point where the circle cuts them, it is obvious that corresponding points, on the perspective plane, will be found by the intersection of the lines which represent them. Thus the line 7 H, intersecting the line 3 C, will give the point e; where it cuts 5 C it will give g, and its intersection with 6 C will give the point Z; and as h and e are both at the same distance from the ground line and the perspective situation of e being already obtained, a line from it, parallel to the ground line, being drawn till it intersect 5 C, will give h also; the place of g being obtained, its corresponding point f will also be found by drawing from g to f a line parallel to the ground line, till it intersect 3 C, where the place of the point f will be marked; and as the intersection of the diagonal line X Z, on the original, with the line A N, gives the centre of the circle; and as the points B G, form the two terminations of a right line drawn through the centre in a direction parallel to the ground line, the perspective situation of those points will be found in the picture by drawing a line through the centre in the same direction, till it intersect the lines 6 C, x C, the perspective representations of the original lines V Z, X Y, on which the line B G terminates.

This circle, which we have thus exhibited, is supposed to lie parallel to the horizon on the ground; but if it were required to describe a circle, standing vertically or perpendicularly to the plane of the ground, the same principle is still applicable, the only variation to be adopted being to change the place of the original plan to correspond to this new position of the figure. If the figure is turned round, so that the line C O shall be the horizontal line, and 6 Z the ground line, the circle will be in a vertical situation. From this the learner will perceive the position in which his plan ought to be placed with respect to the perspective figure; and an attentive consideration of the plate will sufficiently explain the process. When the circle stands parallel to the ground-line, or to the plane of the picture, it undergoes no change in its perspective figure, only becoming smaller according to its distance. In this case, it will be sufficient to ascertain its perspective diameter and centre, and describe it with the compass.

SECT. VII. *Of Triangles, Polygons, &c.*

We have already shewn, Fig. 6. that the perspective representation of any line or point may be given, by considering each separately as a line perpendicular to the ground line, and finding its distance from it by setting it off upon the ground line, and intersecting it by a line from it to the point of distance; but as, in practice, this is frequently productive of much confusion, by the unnecessary multiplication of lines, in general it will be much more expeditiously performed by adopting the method explained at Fig. 10.

Let A D G, Fig. 12. be a triangle; its base A D, parallel to the ground line, and its sides A G, D G, consequently oblique. A G, D G, will be produced to the ground line at a and d. Their vanishing points will then be found, as already shewn, at Fig. 8. by drawing from the point of distance O the line O F parallel to the original line A G, the point F will be the vanishing point of that line, and of all its parallels; in like manner O M will be drawn parallel to D G, and M will be its vanishing point. Each line will then be carried to its proper vanishing point; the line d M will represent the line d D G, and a F the line a A G. The intersection of these two lines at g will give the apex of the triangle at G, and the area $a\,g\,d$ will represent a G d. In order to find the perspective situation of A D, which is parallel to the ground line, from the point D a line perpendicular to it will be drawn, intersecting the ground line at e, and the distance e D will be set off along the ground line with the radius e D at f; draw the lines e C and f L, and their intersection will give h the point required; and as the original line A D is parallel to the ground line, its perspective representation will also be parallel to the ground line; accordingly, draw the line $h\,k$, and the figure is completed.

Fig. 13. Let A B G be a triangle, having all its sides lying oblique to the ground line.

From the point of distance O, the line O F is drawn parallel to A B, F is its vanishing point; O M to A G, M, is its vanishing point; O E to B G, and E its vanishing point; the sides of the original figure are severally produced to the ground line at b g a, from whence each will be produced to its proper vanishing point. By drawing the lines g E, a M, b F, their intersections will give the figure required, as at a, b, g, representing respectively the points of the original figure A B G.

As each of the vanishing points E, M, F, is not only the vanishing point of the original line from which it was drawn, but also of all lines parallel to it, we have, in order further to exemplify this, placed on each side of the original triangle A B G, two other lines parallel to the first. Their perspective representation is found in the same manner, as will be seen by an inspection of the plate.

Having sufficiently exemplified the general principles of oblique perspective, it will be unnecessary to give diagrams of other polygons; it will be sufficient to remind the reader, that every line lying in a different parallel will require a separate vanishing point, which will also be the vanishing point for all lines parallel to it; and that these lines may be divided according to any given measurement, either by means of the points of distance proper to their respective vanishing points, (as by F, Fig. 8. the point of distance of I,) or by the intersection of lines converging to opposite vanishing points, as of a E and b P, Fig. 10. He will also take great care to distinguish the vanishing point belonging to every separate system of lines; as it is obvious, that if the one were mistaken for the other, the utmost confusion in his perspective projection would ensue.

Sect. VIII. *Of Elevations.*

Lines not situated on the ground plane are either perpendicular, parallel, or oblique to it, and will be drawn by finding their seat on the ground in the picture by means of the ground plan; and their perspective height will be found by setting it off upon the ground line, and giving its proper diminution, according to its distance from the observer, by means of the vanishing points.

Fig. 4. Elevations of objects parallel and perpendicular to the ground plane.

Let *a d g e*, Fig. 14. be the perspective representation of a square lying on the ground; it is required to place upon it the elevation of a cube or solid figure of the same height as its length and breadth.

Let A B be the height required, which is equal to A D, its breadth; B C is drawn to C, the centre of the picture, and between the lines A C, B C, the perspective height of the original line A B will be found at any distance from the ground line, by drawing a line at any given distance on A C parallel to A B, till it intersect the line BC. On the point *a*, one angle of the proposed elevation will be found, by raising the line *a b* perpendicular to the plane of the ground, or parallel to the line A B. As the corresponding angle on the opposite end at *d* stands also on the line *a d*, which is parallel to the ground line, the line *d c* will be drawn parallel to *a b*, the point *c* being also of the same height as *b*; and the line *b c* being drawn parallel to the ground line from *b* to *c*, completes one side of the cube.

Before we proceed to the remaining sides of this figure, we shall endeavour to generalise this process, and shew its analogy with a class of lines, the principles of which we have already explained. Let the paper be turned so that B A shall occupy the place of the original ground line A D, the line b a becomes a line parallel to the ground line; and this side of the cube may, in this position of the figure, be considered as a square lying on the ground,—the perspective figure and magnitude of which have already been obtained, on the principle given at Figs. 4. and 5. that is to say, the line *a b* is one side of the square, the point *e* being found by means of the point of distance, the line *e f* is drawn parallel to the ground line, and represents the side opposite to *b a*, and *b f*, *a e*, give the other two sides of the square. The figure may be turned to its original position, the line *e g* will then be drawn parallel to *a d*, and of course to A D, and g h parallel to A B, of the height of *f*, as indicated by the line *f h*. The squares *a b c d* and *e f h g*, represent two sides of the cube standing perpendicular to the ground plane, and parallel to the plane of the picture, and of course undergo no change in their perspective figure; and only become smaller as they recede from the eye of the observer. The lines *b f*, *c h*, being parallel to *ae* and *d g*, their seat on the ground, and being also perpendicular to the ground line, converge to the centre of the picture C,—on drawing which the figure is finished.

If it were required to add to this cube a greater elevation, as A E, the line E C will be drawn to C, the a *a* will be drawn, and its intersection at a, with the line E C, will give the point required. *d* b is of the same height as a, and a line from a, parallel to the ground line, intersecting *d* b at b, will give the point required; and b C, intersecting *g* c, gives c, the other side. This portion which we have just added to the square being above the level of the eye, the line b c, like all lines parallel to the ground plane similarly circumstanced, becomes lower at the further end as it goes to the vanishing point.

In the same manner as the height of the lines c d, h g, have been found, any given height may be found at any point in the picture. Let x be a point in the picture on which it is required to raise a line, perpendicular to the ground plane, of the height of A B; but being at a considerable distance from the ground line, its perspective elevation will be considerably reduced. The lines A C, B C, contain, between them, the perspective height of the original elevation A B, as it would appear at any distance; and the distance being given, if the point lie upon the line A C, as *a* or *e*, the elevation required will be found, as we have already shewn, by raising a line parallel to A B, till it intersect B C; but if the point given lie at either side of the line A C, as x; a line from x, parallel to the ground line, will be drawn till it intersect A C, as at *y*. A line parallel to the plane of the picture will be raised at x, of an indefinite height; the line *y v* will be drawn, which gives *y* the height required, at that distance, which will be transferred to *x z*, the line on which the perspective height A B was required to be marked.

As it may be often more convenient and expeditious to mark the height required without the trouble of transferring it from one line to another, it may be done in the following manner:—x is the point given, draw the line C x, and produce it to the ground line at F, raise the line F G equal to A B, the height given, draw the line G C; and where it intersects x z, as at z, is the point required.

When the ground plan of the figure lies oblique to the ground line, as in Figs. 10. and 15. the elevation will be performed in the same manner as in the preceding figure, only that the original height may be set off either on a line going to C, the point of sight, or on one of the lines which converge to its own vanishing point; thus, the height of the cube A B, Fig. 15. is carried forward to the vanishing point H, but it may be found with equal accuracy by seting it upon the point m, and carrying it to the point C, or indeed any other point on the horizontal line; the height of the cube at the distance o, will be o n; at q, will be q p; so that the result will be the same, whether the height of this elevation be set upon the ground line at b, *a*, or *e*.

Let a *b* g, Fig. 15. Plate 58. be a square lying oblique to the ground line, the sides of which converge to the points H and L; A B is the height given, and may be set up on the ground line at b, *a*, or *e*; in the figure it is at *e*. From the points B and A, the lines B H, A H, are drawn to the vanishing point H; and the line g h being raised from g, till it intersect A H, gives the point h as the height of that line at that distance; vertical lines will also be drawn from the points *b* and a, of an indefinite length; the line h L being drawn from L, and produced to *f*, cuts the line *b f* to the same perspective length as g h; *f* H will be drawn to H, the opposite vanishing point; and the intersection of *f* H with a c, gives c, the height of that line; c L, h H, are carried to L and H, their respective vanishing points; and their intersection at e gives the sides *c* e, h e, which completes the figure.

If, from any circumstance, it had been found inconvenient to place the elevation on any of the points already mentioned, namely, at b, *a*, or *e*, its height might be found at any given point by setting it off any where along the ground, and carrying it to the centre of the picture,—the principle of which having been explained at Fig. 14. we shall exhibit the lines on the figure; but a comparison between this and the preceding figure will be sufficient illustration, without farther verbal description.

If, on the plane *f b* g h, it were required to describe a circle which is situated obliquely with regard to the ground line, the reader will refer to the examples given at Fig. 11. exhibiting circles lying on the ground plane, and perpendicular to it; and the principle there explained may be easily applied to this situation.

Any where on the paper, as at Z, Fig. 15. the circle is drawn of the size given, that is, its diameter is to be equal to the geometrical height of the plane *f* h *b* g, on which it is to be described. The points where the circle touches the square, and where it intersects the diagonal lines (which, without minute reference, the reader will now easily comprehend), will be marked upon the line B A, and carried to H, the vanishing point of the plane on which it is to be drawn, at L; the diagonal lines g*f*, h*b*, will then be drawn on the perspective square; and their intersections will give the points, from which the circle will be drawn with a steady hand.

In case of any doubt or difficulty, we may state further, that as the circle touches the square on the centre of each side, and of the top and bottom, that point on each will be found by drawing through the centre of the plane, at the intersection of the two diagonal lines, for the point at top and bottom, a line perpendicular to the ground plane; and where it intersects L*f*, L*b*, these two points will be found; for the other two points, lying in a horizontal direction through the centre, a line will be drawn from the vanishing point L, and where that intersects f b, h g, the points required will be found. The intersection of the two diagonal lines, with the other lines which converge to the point L, will give the remaining four points required.

SECT. IX. *Elevation of objects Oblique to the Ground Line.*

In the examples of elevations which we have hitherto given, we have exhibited only lines perpendicular or parallel to the ground plane; it still remains for us to explain the laws which regulate lines oblique to the ground plane, or what are usually called inclined planes, the perspective appearances of which are determined by vanishing points, in a manner analogous to that by which objects oblique to the ground line are drawn.

Let *d e b f c a*, Fig. 16. represent a solid figure, like the walls of a house, the side *d e b f* parallel to the ground line, and *d c a b* perpendicular to it. It is required to place upon it the inclined roof, G E D, consisting of two inclined planes, one inclining towards the eye, the other from it. In order to shew more closely the analogy between this species of lines and the figures oblique to the ground line, as exemplified at Figs. 10. and 15. let the figure be turned so that the line O C N shall become the horizontal line, C still being the centre of the picture, O the point of distance, the inclined plane G E D becomes a triangle to be adapted to the end of it, which, as at Fig. 12. will have its vanishing points on the horizontal line. From the point of distance, H, the line H M will be drawn parallel to the line G E, that is, subtending with the horizon the same angle, which is here 25°, and the intersection of the line H M with the line O C N, (which we shall consider as the horizontal line in this position of the figure,) will give M, the vanishing point of the original line or inclined plane, G E; the vanishing point of D E will also be found, by drawing from H, parallel to D E, the line H N, intersecting O C N at N, which is the point required; the line *d* M will be drawn to M, its vanishing point, and *c* N to N, which will be produced till it intersect *d* M at *i*, representing the perspective figure of the two inclined planes, and as the side, *c k*, is parallel to *d i*, it will converge to M, their common vanishing point, and the point *k* will be found by drawing *i k* parallel to *d e*, which in the original position of the figure was parallel to the ground line, and is still parallel to the plane of the picture, and of course does not converge to any vanishing point.

SECT. X. *Inclined Planes.*

The seat of an inclined plane on the ground may be either perpendicular, parallel, or oblique to the ground line, and according to its situation in this respect its vanishing points will be found; and we shall consider each of these classes separately.

1. *Inclined planes perpendicular to the ground line.*—When an inclined plane has no declination from the perpendicular, that is, when its seat on the ground is in a line perpendicular to the ground line, its vanishing point will be found as follows: Fig. 17. Set off the angle of its inclination, B A G, from the point of distance, H, on the horizontal line, and produce it till it intersect the perpendicular line C O, as at D; the point D will be the vanishing point of the inclined surface, a b c d, and for all lines parallel to it: the point of distance will be found by taking the radius

of the distance of the vanishing point D from the point of distance L, drawing D M parallel to H L, the intersection of D M with the arc L M is the point of distance for this vanishing point; if it be required to divide the line a d according to any given measurement, as 1, 2, 3, 4, 5, on the ground line, they will be carried to the point M, and their intersections with d a will give the points required.

Fig. 17. is a wedge lying on the ground; a f on the ground is carried to c, the centre of the picture, d f is its inclined edge, situated with regard to the spectator's eye differently from the other, being inclined from it, and consequently converges to a vanishing point below the horizontal line; it has here the same inclination as the other, and its vanishing point, E, is found on the same perpendicular line, D C E; the angle of its inclination being set off from the point of distance H, and produced to E, will give the vanishing point for the line d f and all its parallels.

2. *Inclined planes situated obliquely to the ground line.*—If the line, the perspective situation of which is required, have not only an inclination from the ground plane, but be also oblique to the ground line, the vanishing points for its ground plan will be found according to their declination from the perpendicular, that is, the degree of their obliquity from the ground line, as shewn in figure 10. Let I, Fig. 18. be the vanishing point of the line a b and all its parallels; it is required to place upon it a roof, inclined at an angle of 30 degrees, both towards and from the eye: The distance of I will be found, (as explained at Fig. 9.) by taking the radius 10, and drawing the arc O A, intersecting the horizontal line at A; from this point the degree of its inclination is set off both above and below the horizontal line, and produced till it intersect the perpendicular line D I E at D and E, which are respectively the vanishing points of the two inclined sides of the roof, and of all their parallels; from a and c the lines a D, c D, are drawn, and from b to E the line b E is drawn, and produced till it intersect a D at d; and as a c is parallel to the plane of the horizon, it converges to N on the horizontal line, and d e being parallel to it, it will be carried to the same point, which completes the figure.

Fig. 19. is a combination of these classes of lines, representing a pavement or other surface, one part, as the lines *a a a*, &c. converging to C, the centre of the picture, and of course giving the perspective appearance of lines parallel to the horizon, b b b, &c. of an inclined plane depressed below the horizon, or inclined from the spectator's eye; these converge to the vanishing point, E, indicating an inclination downwards of 20 degrees. a a a are parallel to the horizon, and converge to the point C, and c c c c represent lines inclined upwards at an angle of 20 degrees, which converge to the point D. The method of preparing this example may be easily gathered from what has already been said in explaining the foregoing diagrams.

Of circles described as inclined planes.—We have already, at Fig. 16. shewn, that inclined planes follow the same laws as objects situated obliquely to the ground line, and that each object lying in a different parallel has, like them, a vanishing point and point of distance proper to itself. Fig. 20. is a perspective representation of a series of planes lying in the same direction, and similarly circumstanced with those described at Fig. 19. on each of which is described a circle: C is the centre of the picture, C L the horizontal line, L the point of distance; the plane 1. is inclined from the spectator's eye 25 degrees; the plane 2. is parallel to the ground plane; the plane 3. is inclined upwards, or towards the eye of the spectator, at an angle of 25 degrees; the geometrical plan of the square, containing the circle, is made on any convenient part of the paper, and the lines *A* b c d *E*, necessary for ascertaining the perspective points drawn upon it, as already explained. We have here made use only of a semicircle, which is sufficient; these will be transferred to the ground-line; the two inclined planes subtending an angle of 25 degrees with the horizon, the degree of their inclination, will be set off from the point of distance L, both above and below the perpendicular line, and being produced till they cut the perpendicular line D C E, give respectively the vanishing points of the two inclined planes at D and E; D M, E N, are drawn parallel to the horizontal line, and the arc L M, L N, with the radii D L and E L, give M and N, their point of distance; the points A b c d E are drawn to the vanishing point of that plane at E; and, in order to form a perspective square, inclosing a circle at *A E* a e, the same process will be adopted as that given at Fig. 11; and if the line E N, Fig. 20. be considered the horizontal line, E the centre of the picture, N the point of distance, the analogy between the two will be complete, and no farther details on this part of the operation need be entered into. Plane 2. being parallel to the ground plane, will have its vanishing point on the horizontal line at C; L will be its point of distance; the line a e, which gives the situation and magnitude of the further side of plane 1. also gives the breadth of the plane 2.; a C e C are drawn to C, and a L being carried to L gives f, which determines the distance of the further side of this square, which will be finished as before directed.

D is the vanishing point of the plane 3. M its point of distance; g D, f D, will be drawn to D, and any distances required will be found by means of the point M. If the learner have any difficulty in completing the figure, he will find every information he may require at Figs. 11. and 15.; and he will do well to attain perfect readiness in the application of the principles given in them before attempting this more complicated species of figures.

SECT. XI. *Of Shadows.*

As light radiates in right lines, the shadow of any object will cover as much space as it would hide from an eye situated in the place of the luminous body; and the shadow of any point of a given object will be found somewhere in a right line, drawn on the ground plane, from a point perpendicularly under the luminous body, that is, drawn from its seat on the ground through the point on the ground that is perpendicularly under the object, the shadow of which is required; and the precise point of this line on which the shadow will fall, will be determined by a right line drawn from the luminous body through the point of the object, and intersecting this line.

Thus let a, Fig. 21. be a luminous body; b its seat on the ground; c a point, being the top of the object c d, the shadow of which is required; from b, the seat of the luminary, the line b d is drawn of an indefinite length; somewhere on this line the shadow of the point c will fall; from a, the line a c being drawn, and produced till it intersect the line b d at e, gives e as the shadow of the point c, and e d as the shadow of c d. In order to exhibit the divergence of the shadows from the seat of the luminary in every direction, the objects f and g are introduced, and their shadows are seen diverging from the point b, in the same manner as the shadow d e of the object c: On the same principle, the shadow projected from the solid figure h i k l will be found, that is, by considering each angle as an insulated point, and finding its shadow accordingly, and afterwards uniting these points by lines corresponding with the lines that run between the angles of the figure: Thus h i, the nearest angle of the solid figure, will be considered as a separate perpendicular object, similar to c d; the line b i o will be drawn from b, of an indefinite length, which will give the place and direction of the shadow; and from a, through h, the line a h o will be drawn, intersecting b i o at o; o is the shadow of the point h, and i o is the shadow of the line h i; in like manner p, the shadow of k, is found on the line l p; q the shadow of m, on the line n q; and as the points o and p represent respectively the points h and k, the line o p will represent the line h k, and p q will represent k m; the line q n will be drawn from q to n, which completes the shadow required.

Upon the principles which we have just laid down, the shadows projected from any object, whatever may be the nature or condition of the luminary, will be found. In practice, however, these principles will be modified by the distance of the luminary; those luminaries, placed at immense distances from the objects, such as the sun or moon, requiring a method different from such as are close to the objects from which the shadows are projected, as torches, lamp, or candle light; thus, in the latter class, the seat of the luminary being always at no great distance, its seat is necessarily not far from the objects, and the shadows will accordingly diverge from that point in every direction; on the contrary, from the vast distance of the sun from the earth, the rays of light, for all the purposes of perspective, may be considered as falling parallel to each other.

From the immense distance of the sun, it is always supposed to be in or over some point of the horizontal line, in which the ground-plane, when extended to an infinite distance, is understood to vanish; and that particular point of the horizontal line will be determined by the number of degrees that the sun is situated to the right or left of the perpendicular that goes through the centre of the picture, if it do not stand over the middle of the picture, and so have its seat on the horizon at the centre, in the same manner as the vanishing point of a right line upon the ground plane, oblique to the ground-line, is found, as shewn at Figs. 8. and 10.

Luminous body behind the picture.—Let H L, Fig. 22. be the horizontal line, C the centre of the picture, H L and E the points of distance; if the seat of the sun on the horizon be in the centre of the picture, it will coincide with C at that point, and the shadows that will be projected on the ground, will be in lines perpendicular to the ground-line, and will follow the same laws as other objects lying in that direction, and its altitude will be found in the same manner as the vanishing points of inclined planes, (Fig. 17.) by taking the angle of declination of the sun's rays, and setting it off from the point of distance; thus, let us suppose that their declination subtends with the horizon an angle of 35 degrees, that angle will be set off from the point of distance L, and produced till it intersect the perpendicular line C E at A: A is the place of the sun, C its seat on the horizon; let *d e*, be a vertical object standing on the ground at *e*, it is required to find its shadow on the ground; the line C *e* is drawn from C and indefinitely produced, and gives the direction of the shadow; from A, the sun, the line A d is drawn, and produced till it intersect C *e* at *k*; *e k* is the shadow of *e d*. Let *f g* be another similar object, and *h i* a third, it is required to find their shadows also; from C the lines C *g l*, and C *i m*, are drawn of an indefinite length, which gives the direction of these shadows; the lines A *f*, A *h*, are drawn from A, and produced till they intersect the lines C *g l*, C *i m*, which give respectively the shadows of these objects, that is, *g l* is the shadow of the object *g f*, and *i m* of *i h*. Now if we unite these three objects e d, g f, i h, by drawing the lines *d f*, *h f*, *e g i*, a figure will be produced in some degree like the gable of a house, and the shadow of this object will be found by uniting with right lines the corresponding points already found in the ground, and filling up the space enclosed by these lines with the shade; and as the shadows of the points *d*, *f*, *m*, are respectively at *k*, *l*, *m*, and as the points *d f h* are united by the right lines *d f*, *h f*, the shadows of those points will also be united by right lines, and k l will be the shadow of d f, and m l of h f, and e k l m i will be the shadow of the object *e d f h i*. B is a cube, its sides lying perpendicular and parallel to the ground-line; its shadow is found in the same manner as the preceding; as C is the vanishing point of this object, as well as the seat of the luminary, the side, a, of the cube, is the only one which projects a shadow; the figure being simple needs no further explanation. D is a cube lying obliquely with the ground line; in this case a shadow is projected from two of its sides; but being conducted on the same principle as the two preceding, no further explanation is necessary.

When the sun does not stand over the centre of the picture, but to one side, its seat on the horizontal line will be found by measuring the degree of its obliquity, like the vanishing point of an inclined plane, having its seat on the ground lying oblique to the ground-line, as at Fig. 18. The angle of the sun's declination from the perpendicular, which we shall here make 35°, Fig. 23. will be set off from the point of distance E, and being produced to the horizontal line, gives A, the seat on the horizontal line of the luminary; the perpendicular line A F will then be drawn from A, and somewhere on that line the altitude of the sun will be found, according to the angle of declination of its rays from the horizon.

We shall here suppose that the rays fall at an angle of 35 degrees. The distance of the vanishing point A, (the seat of the sun on the horizon) will be found by taking the radius A E with the centre A, making an arc E B, which intersects the horizontal line at B, and gives B, the point required. At the point B, the angle of declination of the sun's rays will be set off till it intersect the line A F at F; this gives the place of the luminary. The seat of the sun on the horizon and its altitude being given, the rest of the process will be conducted according to the principles which we have already given; and, more particularly, we refer the reader to the last figure (22.), which will supersede further explanation.

In the examples which we have now given, the sun is placed behind the picture, and consequently the shadows are projected towards the spectator. Two other positions of the sun remain to be considered; first, when the sun is behind the spectator, and consequently throws the shadows from him; and, secondly, when the rays fall in a direction parallel to the plane of the picture.

Luminous body before the picture.—When the sun is behind the spectator, his altitude will be found by setting off the angle of the declination of its rays from the point of distance, to a point below the horizontal line, in the same manner as in Figs. 22 and 23. the points were found for shadows projected from the sun when situated behind the picture, and, like them, it comprehends two different varieties, namely, when the sun is stationed over the centre of the picture, or when he is to either side of it; in both which cases the necessary points will be found respectively in the same manner as already described, and the only difference will be that the altitude of the sun will now be marked below the horizontal line, whereas in Fig. 22. and 23. they were set above it. Fig. 24. Let the altitude of the sun be found, he being situated behind the spectator, his seat on the horizon coinciding with C, the centre of the picture, and consequently his rays having a direction perpendicular to the ground line: We shall here suppose the rays projected at an angle of 30 degrees; from L, the point of distance, a line is drawn downwards, subtending with the horizon an angle of 30 degrees, and intersecting the perpendicular line E, C G, at G; this gives the point G as the altitude of the sun. If it be required to find the shadow of the cube B, the line b C will be drawn to C, the seat of the luminary on the horizon, which gives the direction of the shadow; from the point a, a line is drawn to G, intersecting b C at c, which determines its length; and as that side of the cube from which the shadow is projected is parallel to the ground line, it will be sufficient to draw that portion of the shadow that will be seen in that direction. At D is an object similar to that at Fig. 22. its shadow is projected upon the ground in this new direction; if each angle be considered as a point terminating a right line standing on the ground, little difficulty will be experienced in finding it correctly; and if the reader will examine Fig. 22. and adapt the method therein practised to this new position of the light, a comparison of the two figures will be sufficient explanation.

When the seat of the luminary does not coincide with the centre of the picture, that is, when the rays projected lie oblique to the ground line, the points for ascertaining the shadow will be found exactly in the same manner, as has already been explained at Fig. 22. with only this difference, that the sun's altitude will be placed, in this case, as much below the horizontal line as in the figure just mentioned it was placed above it. Fig. 25. The luminary here has the same altitude, and his rays the same declination from the perpendicular, or degree of obliquity with the ground line, but is supposed to be in front of the picture, or behind the spectator. The angle C E A gives the degree 30° of its obliquity; at A is its seat on the horizon; the angle A B F 35° gives F. its altitude. An object similar to that at *e d f h i*, Fig. 22. is introduced; its shadow converges towards the horizontal line at A, and its length will be found by lines intersecting those converging to A, with lines drawn to F, from the top of the object, as an examination of the figure will sufficiently explain.

Rays falling parallel to the plane of the picture.—When the rays of light are supposed to be projected in a direction parallel to the plane of the picture, the place of the sun must be over the horizontal line at an infinite distance from the centre of the picture, and consequently the perspective appearance of the shadows will be parallel to the ground line and to one another, and no vanishing point will be necessary.

Let 2, 3, Fig. 26. be objects standing perpendicular to the ground plane; the line F is drawn parallel to the direction of the sun's rays, which in this figure subtends with the horizon an angle of 35°; from the bottom of each object or separate angle of an object, lines are drawn parallel to the ground line, which give the direction of the shadow, and its length is determined by drawing from the top of each object, or angle, a line parallel to F, and where that intersects the line drawn upon the ground from the bottom of the object, the point required will be found; thus, b c is the line which gives the direction of the shadow of the corner of the cube, and is drawn parallel to the ground line, and a line being drawn from the top parallel to the ray F, gives the termination of the shadow. It would be an unnecessary repetition to consider each other object of this figure separately, as an examination of the plate will render the principle perfectly clear and distinct.

SECT. XII. *General Observations.*

The form of a shadow projected from any object will be modified by that of the surface which receives it; thus, the shadow of a strait line falling upon a flat surface will be strait; upon a cylindrical, spherical, or other curve, it will receive a corresponding degree of curvature; and when the shadow is thrown upon an inclined surface, it will also be inclined. When part of the shadow of an object that would fall on the ground is intercepted by another object, it will assume the form of the surface on which it is thrown, as we shall shew. Let A, Fig. 27. Plate 59. be a cube, and B a perpendicular object, projecting a shadow on the ground, part of which is intercepted by the cube, (the light here comes in the plane of the picture;) F gives the declination of the rays; from the bottom of the object B, at a, the line a b is drawn parallel to the ground line, and the line B b being drawn from B parallel to F, intersects a b at b, and gives the shadow of the object as it would appear on the ground if the cube were removed. It is now required to find that portion of the shadow which falls on the cube; from the point c, that part of the cube which intersects the line a b, a line is drawn perpendicular to the horizon, and where it intersects the upper angle of the cube at d, it gives c d, the portion of the shadow which is thrown on that side, and from d a line is drawn parallel to the ground line till it intersect the other side of the cube at e, which gives the whole of the shadow received by the cube. The line d e is drawn parallel to the horizon, because the upper superficies of the cube is in that direction, and it is obvious that if it had been inclined the line d e would have been in that direction.

Fig. 28. represents an object similar to B of the preceding figure, projecting a shadow in the same direction, part of which is intercepted by an inclined plane; the lines a b, and B b, are drawn as before, and give b, the length of the shadow thrown on the ground. At the point c, the line of the shadow intersects the bottom of the object; c d is drawn from c, perpendicular to the ground plane, till it intersect the nearest side of the inclined plane; and the line d e being drawn from d, till it intersect the lower part of the inclined plane at e, completes the shadow of the object on that plane.

Fig. 29. represents a cylindrical object intercepting the shadow of an object like B of the preceding figure; its shadow will be circular; the highest part of it will be found by observing where the shadow on the ground cuts the line a b, representing the base of the cylinder, which it does at b; and from this point a perpendicular line is drawn equal to its apparent diameter, which is found by drawing from the point c the line c d, towards the vanishing point of the cylinder, which being intersected by b d, gives d, the place of the shadow on that point of the cylinder. In a figure of greater magnitude, two or three points in the circumference of the cylinder may be marked in the same manner as the diameter b d was found; the horizontal diameter e f, is marked on the end of the cylinder, and its seat on the ground, g h, is also found; g is produced to the vanishing point H, and where g H intersects the shadow, as at k, a perpendicular line will be raised; and the intersection of the line H with it, gives the point required at i.

From the examples of shadows which we have now given, it will appear evident that the perspective appearance of the shadow of any object upon that which intercepts it, will be exactly the same as a section of that intercepting object made in the direction of the shadow.

We have thus given the principles by which the shadows of all objects may be found, in whatever direction the rays of light may fall upon them. Our limits will not permit us farther to illustrate their application to particular cases; but if we have made ourselves clearly understood, our readers will find little difficulty in making that application themselves; at all events, they are sufficiently prepared to engage in the more complicated details of the subject, which are to be found in larger treatises.

SECT. XIII. *Of the Images of Objects reflected in a Mirror, or in Water.*

An object reflected in water, or a mirror, has exactly the same form and dimensions as its original, but is inverted, and its perspective figure will be regulated by the same laws as such an object would if inverted and attached to its base, where it meets the line of the water. Let A B C, Fig. 30. be three posts standing vertically in the water, their images will be found by producing each downwards, and cutting it off to the same length as the original: If we consider these three lines as forming the boundary or profile of that object, terminating with an angle at the top of the line B, which is formed by a line drawn to it from the top of the other two, as indicated by the lines a b, c b, from the top of A and C, the perspective appearance of this object will be found by drawing corresponding lines from the points by which the angles are represented, to the point where they intersect; thus the point *a* representing a, *b* representing b, and *c* representing c, the line *c b* will represent c b, and *a b* will be the reflected image of a b; and consequently the angle *a b c* will be a true representation of the angle a b c.

The manner in which the reflexion of these angles has been found, will already have suggested to the reader the principle on which inclined objects will be reflected; but in order to render this more clear, we shall add a few more examples. Let E, Fig. 30. represent a right line, or post, standing in the water in an inclined position, but reckoning from its base E, to the seat on the water of its upper extremity F, it lies in a direction parallel to the plane of the picture; from its seat f, to F, the occult line f *f* is made equal to f F, and gives *f* as the reflection of the point F; and the line *f* E being drawn from *f* to E, gives the image of the object required.

Let G H be a similar object; g the seat on the water of the extremity G: If a line were drawn from the point H, parallel to the horizon, the point g would be considerably above it, thereby shewing that the point G is farther from the spectator than H; the dotted line *g* g being made equal to g G, gives *g* as the perspective situation of the image of the point G; consequently *g* H will be the perspective situation of the image of the object G H.

Let I K be another figure similar to the preceding, but with its upper extremity, K, inclined towards the spectator; k is the seat on the water of K, differing from the last figure in this, that K being nearer the spectater than I, has its seat k nearer the ground line than I, which in the preceding figure at g was farther removed; the line *k* k being made equal to k K, gives *k* the image of the point K, and the line *k* I being drawn, gives the image *k* I required. By the term *seat on the water*, we mean that point on its surface, on which a line dropped from the object perpendicular to the plane of the water would fall; and our readers will have traced the analogy between this and what we have called the seat on the ground of any object, a term which, in the course of this treatise, we have frequently made use of.

We have said, that the images of objects in water follow the same laws, and have the same appearance to the spectator, as an object similar to the original object, but inverted, would have if viewed from the same point; and if a series of objects come behind one another, as much of the image of each would be seen as of a real object inverted, if viewed at the same point. The perpendicular wall a 4, Fig. 31. and the several courses of stones of which it is composed, the arch, &c. follow strictly the same law which we have given at Fig. 30.; but the steps of the stair standing at different levels, and at different distances from the water's edge, require some farther explanation. When objects are thus circumstanced, it will be necessary to find the point at which the water, if produced to the base of the objects, would be intersected by a vertical line drawn from it, as the point k, Fig. 33. C is the vanishing point, to which the lines 4 C, 3 C, 2 C, 1 C, converge, giving the termination of the steps the images of which are required. The images of those lines are found by marking the dots at their proper distances on the line a b, the image of the original line a 4; and the lines a C, b C, &c. being carried to C, give the distances required; a vertical line drawn downwards from the front of the first step, gives z as its seat on the water, and as the original object is parallel to the ground line its image will be drawn in that direction; the seat of the third and second steps are found respectively on the points y and x, and the distances of their original points being measured from y and x respectively in the same manner from the upper step, give their images in the water; the first step being situated on the water's edge, has its image of the full length. The image of the arch is of the same figure as its original; and the line c C gives the direction of the water receding within the arch.

As the trees in the back-ground stand upon an irregular surface, and at considerable distance, they afford no certain data for finding their exact height above the level of the water; this must therefore be assumed, and in this example is placed at the point e; and this distance being doubled from e downwards, shews what portion of the trees would be intercepted, and what would be visible to the spectator.

It will be observed that one side of these objects is parallel to the ground line, and that the other converges to the vanishing point C, and that the horizontal lines of each side are respectively parallel to each other; consequently their images will also be perspectively parallel to them, each to each, and those lines that are parallel to the ground line will have their images also parallel to it, and those that converge to the vanishing point will have their images also converging to it.

In the practice of painting, it very frequently happens that the object, the reflection of which is required, does not stand at the water's edge, but is at some distance, and may be also considerably elevated above its surface, and consequently presents great difficulty to those who are not sufficiently experienced in the art of perspective. When objects are thus circumstanced, it will be necessary to find the point where the vertical lines of the object, if produced downwards, would intersect the surface of the water if it were produced to the base of the object in its horizontal direction. Let Fig. 32. represent an object consisting of five columns, situated on an eminence, the dots under each column mark the point where the water would wash the base of the building, supposing the earth or ground were removed which covers their foundation; from this point or seat of the building in the water, the visible parts of the object, and profile of the ground on which it stands, will be marked as in the former examples; an inspection of the plate will be sufficient without further explanation. It may be also remarked that the ground on which the building stands is supposed to be a plane inclined from the spectator, that is, having its highest part receding from the edge of the water. The reader will turn to the inclined object H G, Fig. 30. which will serve to illustrate this still farther; g is there the seat of G; a horizontal line was drawn from H, which, in reference to Fig. 32. we shall consider the edge of the water, consequently all the upper portion of the dotted line g g, which lies above this horizontal line, will be invisible, and will account for the image of the bank, Fig. 32. on which the building stands, and part of the columns not being reflected in the water. If the point of sight in this example had been lower, the difference between the objects and their reflected images would not have been so great; and if the spectator's eye were on a level with the surface of the water, whatever might have been the relative distance and situation of the objects, they would have the same images, and occupy the same relative situations with respect to each other in the water as they themselves presented above it.

The bridge at Fig. 32. as it stands perpendicular to the plane of the water, will have its reflection described in the same manner as at *a b c*, Fig. 30; but a portion of it is concealed by the projection of the bank on which the columns stand, and its reflection. The tower on the left follows the same law as the rest, and a small point of land is projected into the water on which the cattle stand; they are also reflected in the water, and, in some degree, interrupt the reflection of the objects behind them; if that part of the water above the cattle, on which the lower part of the circular tower is reflected, were removed or concealed by the intervention of any other object, it is obvious that no reflection of that part of the tower would be seen; the remaining portion of it which falls on the water below the cattle would still remain as formerly. This consideration will tend farther to illustrate the principle on which part of the columns, and so great a portion of the bank on the opposite side, reflect no images in the water. In the foreground is a range of stepping stones lying perpendicular and parallel to the ground line; their reflected images will be found as already explained at Fig. 31. and the lines lying perpendicular to the ground line in the reflected image will converge to the same vanishing point as their originals.

The rules which we have now given for representing the reflected images of objects are equally applicable from whatever surface they may be reflected, provided the surface be flat and smooth. As water, however, is seldom entirely smooth and unagitated, it is but rarely that we find in nature the images of objects so perfect as when reflected from a mirror or finely polished plate of metal. Accordingly, in the practice of the art, the principles which we have given will be modified by the supposed degree of agitation or stillness in which the water may be. Thus the gentle undulations produced by the water-fowl moving on its surface, and the like, will have the tendency to elongate and interrupt more or less the continuity of the lines of the reflection; if the agitation exist to a greater degree, as by the force of the wind, the image will be less distinct; and if the motion be very great, no reflection whatever will take place. But of this no direct rule can be given; an attentive observation of nature, and tracing the appearances that present themselves to their causes, can alone direct the painter in this interesting part of his art.

When water is muddy and opaque, as after heavy rains, it is capable of sustaining a shadow like a solid substance; and if the surface be sufficiently smooth, the reflected images of objects will at the same time be seen, and a curious appearance will be observed when the sun shines, exhibiting both the shadow of any objects that may be near it, as projected from the luminary, and their reflected images, both which will be respectively regulated by the laws which we have given for each; as in the case which we have now mentioned the water is coloured and rendered opaque by the presence of some foreign matters, whatever they may be, it will communicate its colour to the shadows and reflected images. This circumstance, though in general perhaps no way picturesque, we conceive worthy of notice as an appearance of nature, with every variety of which the painter ought to be perfectly familiar, and which may even in practice be occasionally useful.

In order more fully to explain the laws which regulate the reflected images of objects in water, we have given a diagram constructed after the manner of a vertical section, more particularly with a reference to the columns at Fig. 32. Let A e, Fig. 33. be a column or similar object; e B a bank on which it stands, sloping to the water's edge; B g the profile of the bank e B, reflected in the water, and g a that of the column; B k the level of the water; and C is a spectator viewing those objects. Now we have already shewn, at Figs. 1. and 2. that a right line passing from any part of an object to the eye of a spectator, and intersecting a plane set up vertically or perpendicular to the horizon, and also to the direct ray of vision, as E C, Figs. 1. and 2. like the plane Y, Fig. 4. will give at its point of intersection the perspective situation of that object or point: this law is the basis of the whole art of perspective, and the reflected images of objects are equally subject to it.

The line a h is the transparent plane, and the points a, e, b, g, h, where the line a h is intersected by the lines A C, e C, B C, &c. give respectively the relative situation and magnitude of these objects on the transparent plane. Thus the perspective situation of the column A e will be found between the points a and c; that of the bank e B on which it stands at c b; b the level of the water; b g represents on the perspective plane the reflected image of the bank B g, and *g* h that of the column g a.

We have already shewn, in our illustrations of this subject, that the images of inclined planes, according to the circumstances of elevation under which they are viewed, differ materially from the appearance of their originals, while those objects which lie parallel to the plane of the picture reflect images uniformly the counter-part of their originals. Thus, we find, on the line a h, the space *g* h is equal to its original a c, as a g is equal to A e; the plane or bank e b, being inclined towards the eye of the spectator, is seen of considerable magnitude, while its reflected image b g, following the same law as planes inclined from the spectator, is proportionally foreshortened. We have already said that the image of any object the base of which is removed from the water's edge, and interrupted by the intervening ground on which it stands, will be found by producing, or supposing to be produced, the line of the level of the water, and the line of the object, till they intersect each other, which point of intersection will give what we have called the "seat of the object in the water." Thus the lines A e and k B are produced till they intersect each other at k, which is the seat of the object A e on the water. Although it is obvious that the point k could not be seen by the spectator C, being obstructed by the bank e B, it must always in practice be understood, and even if not done with mathematical accuracy, still a thorough knowledge and just application of these principles will be sufficient to give the necessary correctness and consistency to the several objects in relation to each other. If it were required to mark on the plane a h, the seat of the object on the water, a line will be drawn from k to C, and its intersection with the plane a h will give its perspective situation, and this point will occupy the same relative situation with *a* and *h*, as k to a, and A in the original,—which in this example is in the centre.

It would be both amusing and instructive to the reader to examine the changes that would take place between the relative proportions of the objects, and their reflected images, by varying the place of the spectator. If he were stationed at a higher point, as at Y, and the rays drawn to it instead of C, their intersection with a plane like a h, would shew that the projecting bank e B would present no image itself, and also cut off even a portion of the column A e; on the contrary, if the plane of the spectator were lower, as for instance at the water's edge, Z, the images would be exactly the same as their originals, as no object would obstruct the image which would not also intervene between its original and the spectator.

It will be unnecessary, in this place, to enter on any detailed explanation of the physical cause of the reflected images of objects from bright or polished surfaces. It will be sufficient to state the general law, that those images are transmitted to the eye of the spectator from points on the reflecting surface at which the same angle is subtended to the object reflected and to the spectator; or, according to the usual enunciation of this law, where the angles of incidence and reflection are equal. But, for all practical purposes, it will be sufficient to consider the reflected image of every object, as another object, the counter-part of its original inverted; and the lines drawn from points on this inverted image to the eye of the spectator, will be found to intersect the surface of the reflecting medium at the point where the angles of incidence and reflection meet, as already explained. To illustrate this more fully, let the line A i be a ray falling upon the water at i, which gives A i B, the angle of incidence of the point A; the line i C gives the angle of reflection C i Z, which is equal to A i B; consequently i is the point on the surface of the water from whence the image of the point A will be reflected to the eye of the spectator, when stationed at the point C; and whether we consider the reflected image a g B, as a real object inverted, the counter-part of its original, or only its image, the lines drawn from its several points to the point of sight, as a C, g C, would intersect the line of the water at the same angle as that subtended at the point of incidence by the angles of incidence and reflection; that is, the angle a i B is equal to the angle subtended by the ray of incidence A i B; the angle g i B is equal to the angle e i B; and so on with any other objects in the picture.

When it is required to represent the reflected images of clouds, by reason of their very great distance from the spectator their seat on the water will be reckoned from the horizontal line.

SECT. XIV. *Practical Illustrations.*

We have at Plate 60. introduced a number of objects, selected as practical illustrations of the principles laid down in this treatise; and in their selection and arrangement, we have also endeavoured to combine picturesque effect with preceptive utility. Fig. 34. Plate 60. is an arch situated perpendicularly with respect to the ground line. The perspective of the circle is explained at Fig. 11. Plate 57. In this example it is only a semicircle; the geometrical figure of the semicircle is set up of a suitable diameter, and the three points at which it touches the parallelogram that encloses it, are marked at 1, 2, 3; from the centre to the upper angles of the parallelogram right lines are drawn; and at the point where these diagonals intersect the circle, viz. at 4 and 5, the horizontal line is carried forward to the side, on the line h 1, these points being all correctly found in their perspective situations by carrying them to the point C, the centre of the picture, and following the method given at Fig. 11. the semicircle A B C D E is drawn. In order to describe the inner circle of the same diameter, the thickness of the wall being given, it is set off along the line 1 3 at 6; and from this point the line 6 e is drawn towards the centre of the picture at C, till it be intersected by the the line E e; the line A E may be considered the base line or seat on the ground of the arch A C E; the line 6 e is the base line of the inner arch, required, and it may be described by finding points corresponding with A B C D E of the original figure: as, from the situation of the spectator, with regard to this inner circle, a fourth part only of it appears, it will be necessary to find those parts corresponding with C D and E only. From the point D, the line D f is drawn till it intersect the line A E at f; C g to g; the lines E e, f *f*, g *g*, are drawn respectively from the points E, f, and g, till they intersect the base line 6 e. From the points *f* and *g*, lines are raised perpendicularly to the horizon, and produced till they are intersected by the lines C e and D d; that is, the line *g* e is made equal to the line g C, and *f* d to the line f D; and from E, the line E e being drawn, gives e, the point at which the inner arch springs from the wall; the points e d c are united by a line, which describes all of the inner circle that could be seen from this point. The lines E e, D d; C c, are in this example drawn parallel to the ground line, because these points lie, with respect to each other, in that direction; but if the arch had been situated obliquely to the ground line, those lines must necessarily have been carried to a different vanishing point, as the point H, Fig. 15. Plate 58.

At F, Fig. 35. is a semicircle, parallel to the ground line, which is of course drawn with the compass, objects in this position undergoing no change in their perspective figure. The inner semicircle connected with this figure, being also parallel to the ground line, will be drawn with the compass, but, being further removed from the spectator, will be smaller in its diameter, and the true size of it, as well as the place of its centre, will be found by attending to the rules given for finding the seat on the ground of objects the sides of which are perpendicular and parallel to the ground line, as explained at Figs. 4. and 5. The nearer circle being drawn with the radius a b from the centre a, and the point c being given, indicating the thickness of the wall, or distance of the one circle from the other, from c, the line c d is drawn parallel to the ground line, of an indefinite length; and from the original centre a, the line a d is drawn to C, the centre of the picture; the intersection of the lines c C, and c d, at d, gives the centre of the other circle required; from which point, with the radius c d, as much of it will be drawn as will be seen at this point of view, the circle in front concealing a considerable portion of it.

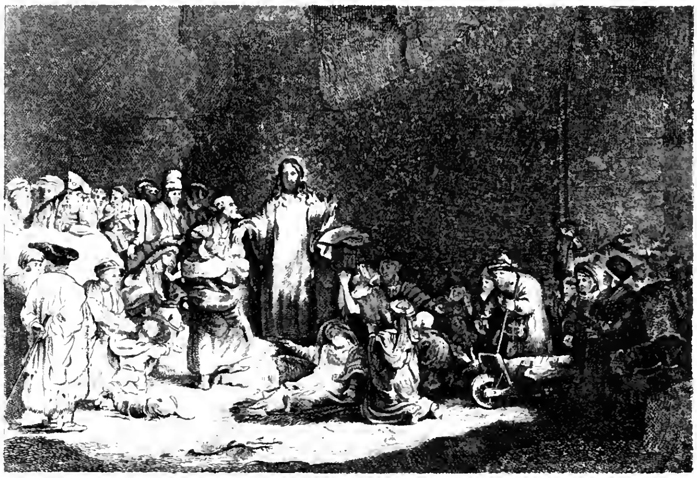
The circular temple, Fig. 36. exhibits another variety of this class of objects; the two concentric circles, containing the ground plan of the columns, may be placed, in this instance, more conveniently above the object; and if any difficulty presents itself from varying the position, the reader, in applying this rule to practice, may turn the paper upside down, and he will then have the plan in the position, with regard to himself, to which he may be more accustomed, and the analogy between this and the examples of elevations given at Figs. 14. and 15. will be more obvious; Y Z will be the ground line; Y X will be the elevation on which the circle and its columns are to be placed.; and the circle being drawn, the points 1, 2, 3, 4, 5, 6, are transferred from the ground plan to the line X V, and are then carried to the vanishing point; their intersection with the circle gives their perspective situation and diameter.

M, Fig. 37. is a building with a pediment in front, having an inclination with the horizon of 20 degrees; its ground plan is perpendicular and parallel to the ground line, consequently C is its vanishing point,

PAINTING (CHIAR' OSCURO)

1 CORREGIO.

2 REMBRANDT.



3 RUBENS.

7 AN. CARACCI.

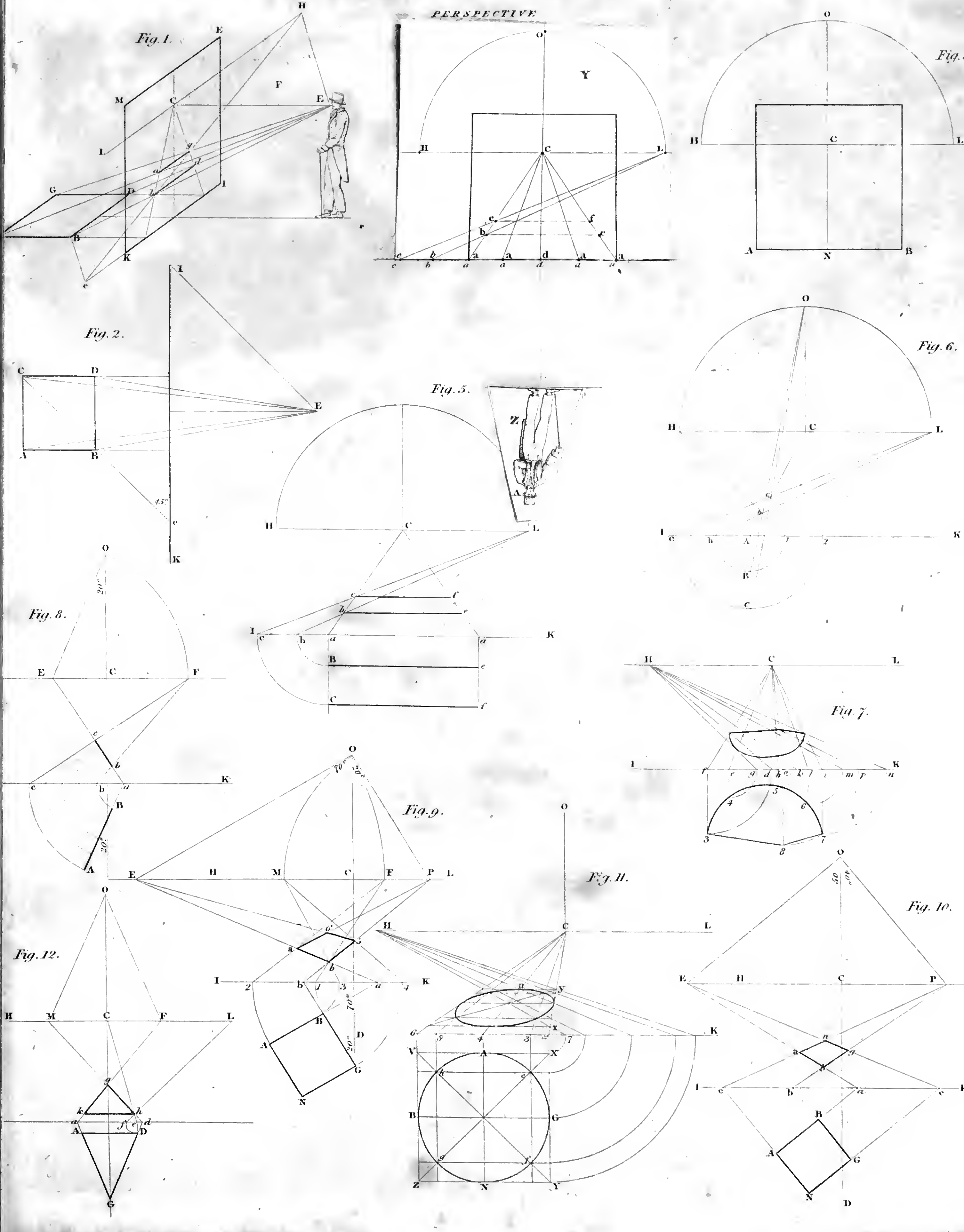
6 TITIAN.

4 ELSHEIMER.

5 REMBRANDT.

Engraved by W. & D. Lizars Edinburgh.

ARTS OF DESIGN.



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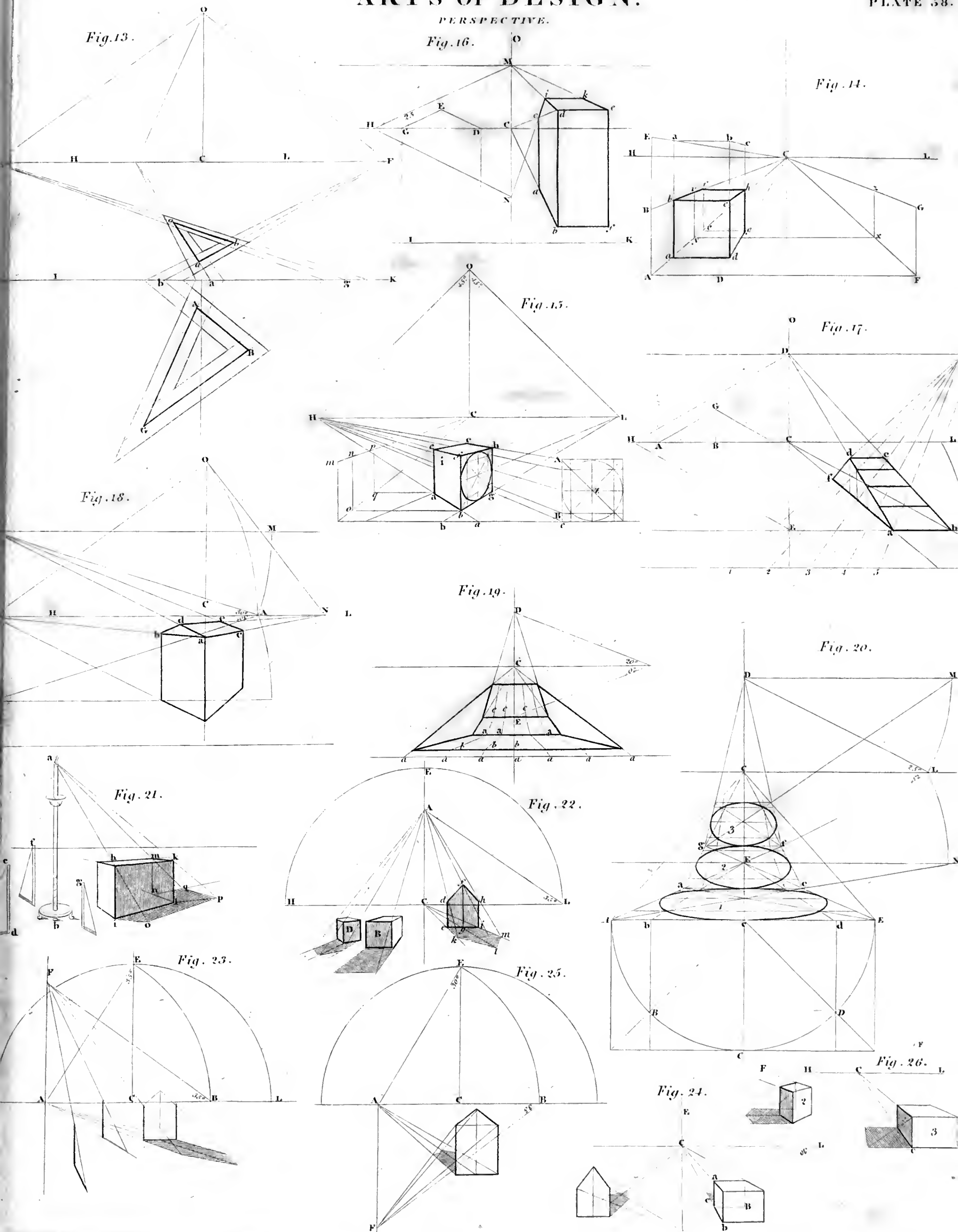
PERSPECTIVE.



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PERSPECTIVE.

Fig. 27.

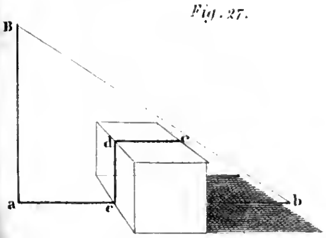


Fig. 28.

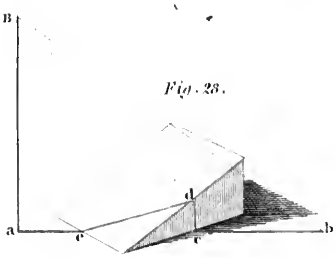


Fig. 33.

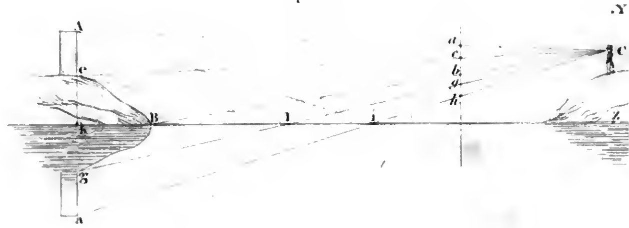


Fig. 32.

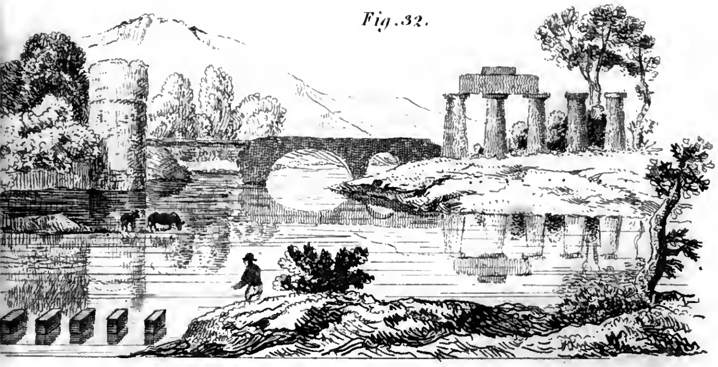


Fig. 31.

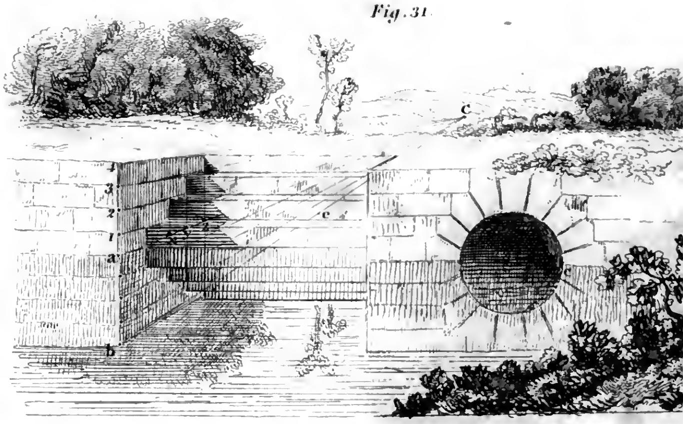
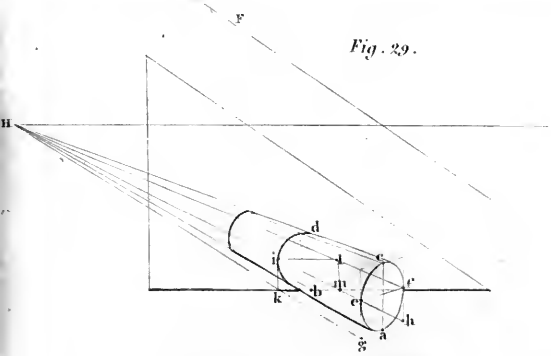
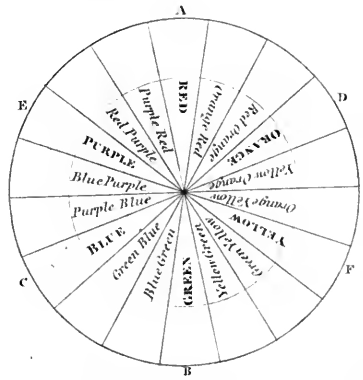


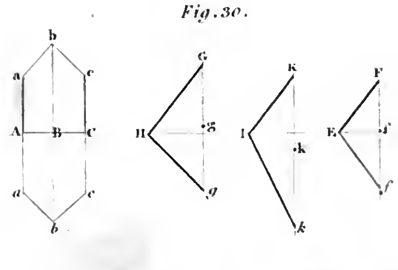
Fig. 29.



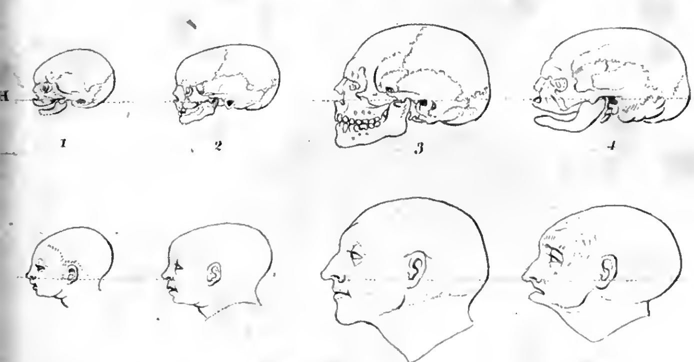


CONTRAST OF COLOURS.

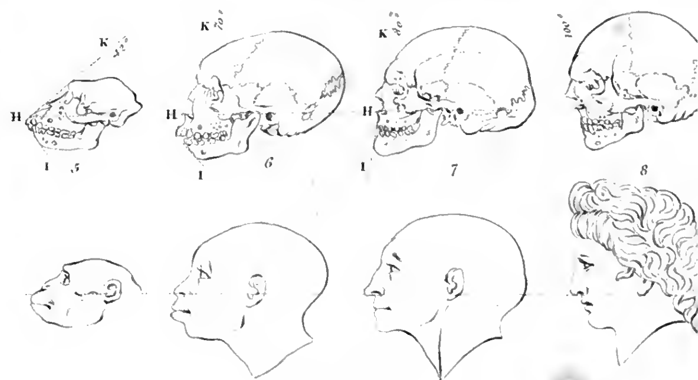
Fig. 30.



CHANGES IN THE HUMAN HEAD FROM INFANCY TO OLD AGE.



FACIAL ANGLE FROM CAMPER.



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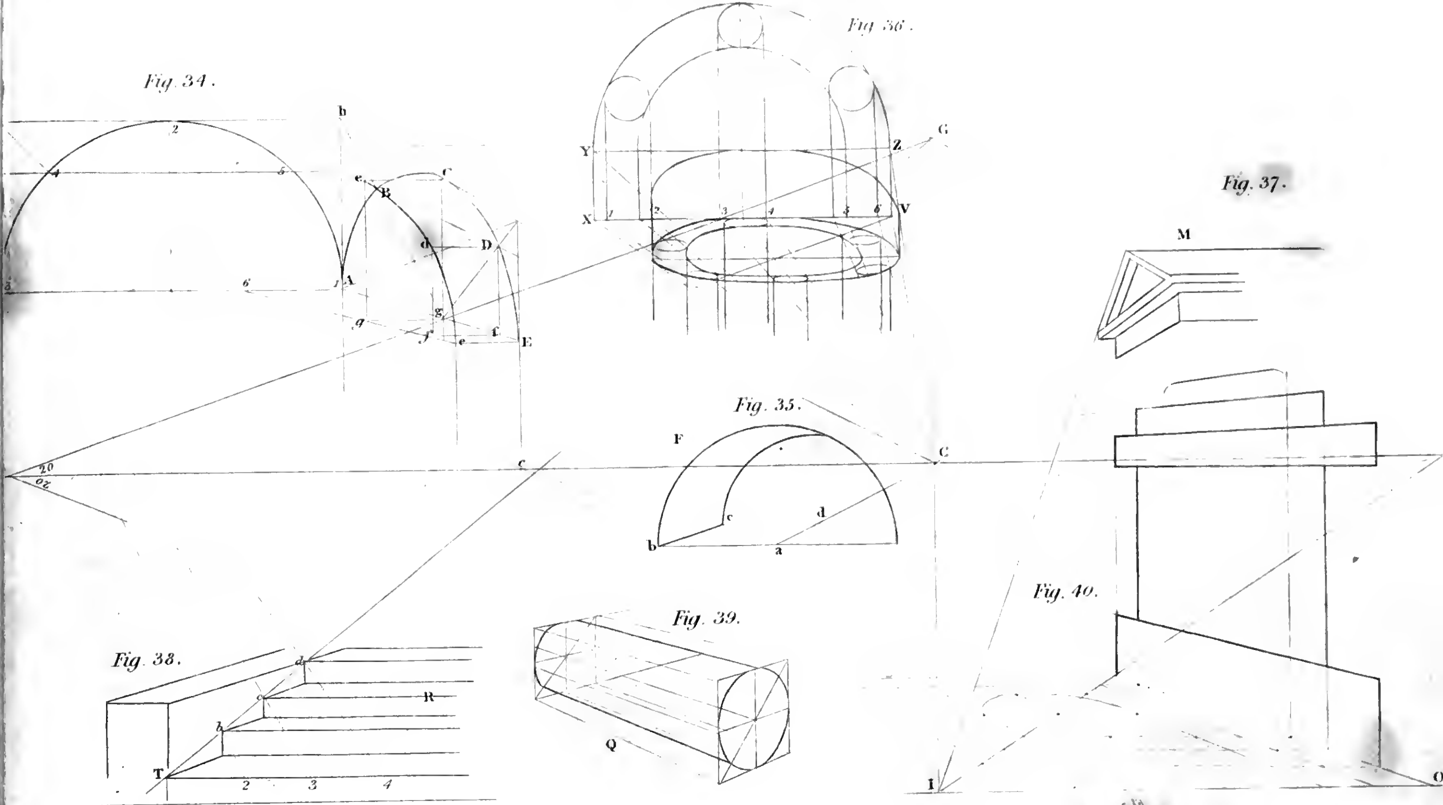
ARTS OF DESIGN.

PERSPECTIVE.



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and H its point of distance. From H the vanishing points for the two inclined planes are set off at an angle of 20 degrees, and give G and I their vanishing points, as more particularly detailed at Fig. 16. N is a column on the foreground, exemplifying squares and circles at different heights; their places or seat on the ground are marked within the plinth, and the profile of their respective altitudes on the line O P, and carried to the vanishing point C; and the elevation of the profile is drawn, giving the true height of every part of this object. Lines are drawn of an indefinite height from the seat on the ground of each part of the figure, as indicated by the ground plan, and these are cut off, according to their true height, by referring to the elevation, and the principle on which this is done will be found at Fig. 14. Q, Fig. 39. is a cylinder, or fragment of a column, lying in a direction oblique to the ground line, having H and L for its vanishing points; it is first drawn as a square figure, and the circles at each end are inscribed within it, from the extremities of each of which lines are drawn to its vanishing point H, as described at Fig. 15. R, Fig. 38. is a flight of steps, having an inclination 20 degrees above the horizon, consequently G is its vanishing point, S its distance; the line T G being drawn, gives the upper angle of each step; and the distances 2, 3, 4, being set off on the top of the first step from T, and being carried to S, their point of distance, give b, c, d, their places on the line T G. The steps individually, and the wall at each side, being parallel to the plane of the horizon, are drawn to the centre of the picture; and from b, c, and d, a vertical line is drawn, which gives the front of each step; and as the other lines of this figure are parallel to the ground line, they are drawn in that direction. Fig. 40. shews the method of finding the different members of the column, with its base and pedestal. The perspective representation of the ground plan of its various projections is drawn according to their given proportions. It consists entirely of squares parallel and perpendicular to the ground line 4, 5, 6, and circles, the method of delineating which has been given at Fig. 11. The elevations of these members are set upon the ground line upon the line O P, as at Fig. 14. and carried to the point C, which, for want of room, has been adopted for the point of sight for this figure. The profile of the elevation is now drawn, and, from the points on the perspective plan, the several lines are raised, and they are cut off their proper height by referring to the profile, according to the principles given at Fig. 11.

The figures of this plate, for the sake of greater distinctness, are made somewhat larger than those in the etching below to which they refer, and without preserving strict uniformity between the proportions of their several parts; and they being all referable to principles which have been already exemplified in the treatise, it has been thought unnecessary to detail the more minute steps by which their form is obtained.

We shall now add a few general observations, with which we shall conclude what we have to say on the subject.

In the precepts which we have given, we have uniformly adopted the plan of having the distance and proportion of every object delineated according to accurate measurement. But in practice this is not at all times necessary; and, in general, if the vanishing points be properly placed, the objects delineated will be perfectly consistent with themselves, and, for most purposes, sufficiently correct without this. In drawing from nature, the objects are accurately proportioned to one another, according as they appear to the spectator from the point from which he views them, and their sloping appearance is given by finding the vanishing points to which they must converge.

In fixing the distance of the picture, that is, the distance of the points of distance from the centre of the picture, the painter must guard against bringing it too near; in general, the best distance at which it can be fixed is about as far beyond the outside of the picture as the outside is from the centre; and if an injudicious choice be made in the distance of the picture, by bringing it too near, it will distort the objects and, though accurately drawn according to the rules, they will appear incorrect and offensive to the eye. Although the rules which we have given need not at all times be strictly followed in practice, it is not the less necessary to know them profoundly, and so prevent numerous errors which uneducated persons are liable to commit, particularly in cases out of the usual track of their observation or practice; like those who, though unacquainted with the principles of grammar, by practice or feeling, acquired by reading or hearing correct language, may seldom commit great errors, yet never fail to betray their ignorance by the incorrectness of their diction in a thousand minor mistakes.

Names of Artists mentioned in the preceding Treatise.

Artists Names. — Arts of Design.

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DESIGN denotes those figures which are formed of different fabrics of cloth, as damask or silk stuffs. See Cloth Manufacture.

DESPOT, in its general acceptation, signifies an absolute prince or ruler, and seems to have been originally equivalent to the Latin *herus* or master. But in process of time this term was subject to the same change on medals as, among the Latins, took place with regard to Cæsar and Augustus; *Basileus* or king corresponded to Augustus, and *Despot* to Cæsar. The emperor Alexius created the dignity of despot, and made it the first after that of emperor. Those who held the title of despot were usually the sons or sons-in-law of the emperor, as well as their colleagues and presumptive heirs.

DESSAULT, Peter Joseph, an eminent French surgeon, was a native of Franche Comte, and was born in the year 1744. Descended from a family in an humble station of life, he received the early part of his education among the Jesuits, and was destined for the clerical profession. But as the study of medicine was more congenial to his own inclination, he was settled as an apprentice in the military hospital of Befort, where he acquired some knowledge of anatomy and surgery; and, as a proof of his assiduity in those studies which should qualify him for his future profession, he translated the work of Borelli, *De Motu Animalium*, to which he added notes and illustrations.

In his 20th year Dessault commenced his studies in Paris, and he subjected himself to so much labour and industry in their prosecution as to injure his health, by which he was confined to a bed of sickness for a twelvemonth. Soon after his recovery he commenced teacher of anatomy, and was attended by 300 pupils, of whom a great proportion was older than himself, for he was then only in his 22d year. The extraordinary success of so young a teacher excited the opposition of enemies and the jealousy of rivals, and rendered it necessary that he should proceed under the sanction of another name. His unceasing perseverance and distinguished acquirements enabled him to surmount every obstacle that opposed his professional career; and scarcely twelve years had elapsed when he was regarded as one of the first surgical practitioners, and the most eminent teacher of anatomy and surgery in Paris. His great talents and high reputation raised him to the most conspicuous stations in the hospitals; an audience of 600 students was frequently assembled to hear his instructions; and most of the surgeons of the French army attended his lectures.

In 1791, *A Journal of Surgery* was begun, under the auspices of Dessault. In this work the cases of greatest interest which occurred in the clinical school were recorded; and it afforded an illustration of his simple and efficient practice, as well as of the excellent improvements which he had suggested and introduced. But in the succeeding year his useful labours were disturbed by the distracted state of the times. Charged with *egotism* or *indifference*, he was seized while he was delivering a lecture, hurried to prison, and kept for some days in confinement. When restored to liberty, he was permitted to resume his professional pursuits; but the barbarous scenes which the metropolis exhibited in the year 1795, made such an impression on his mind as to throw him into a fever, which terminated his life in his 51st year. With an ardent temper, which, it is said, sometimes exceeded the bounds of moderation, Dessault was passionately attached to his profession, and indifferent to other pleasures and enjoyments; fame, and not emolument, was the sole object of his ambition. *A Treatise on Diseases* which require surgical treatment, in 2 vols. 8vo, is the only work of which he is to be regarded as the sole author.

DESSAW, or Dessau, a town in the principality of Anhalt, Dessaw, in Germany, stands on a fine plain on the banks of the river Mulda, not far from its junction with the Elbe, contains several spacious modern streets and elegant public buildings, among which the palace, the riding-school, and some of the churches, are most conspicuous. The population is estimated at 7000, and the chief manufactures are woollen cloths, stockings, and hats. A society has been established at Dessaw for printing and publishing books on account of the authors themselves, without the interference of booksellers, which, it is said, has been the means of contributing greatly to the diffusion of knowledge. What other effect an institution of this kind could produce with this view, except in being satisfied with a smaller profit, for, in other respects, it comes in place of those who usually transact the business between the author and the purchaser of books, it is difficult to conjecture. The embankment which secures the low grounds in the vicinity of Dessaw from the inundations of the Elbe, and which is about four miles in length, 60 feet broad at its base, and ten or twelve feet in height, is a remarkable example of human enterprise and labour.

DETINUE, a term in English law, which signifies a writ or action that lies against one who has goods delivered to keep, and refuses to deliver them up. In this action the thing itself detained is generally to be recovered; but if this be impossible, the prosecutor may recover damages for the thing claimed and also for the detainer; and the thing claimed must be positive and certain, so that it may be known and recovered.

DETONATION, a peculiar modification of combustion, in which the process is instantaneous, and is usually accompanied with noise, in consequence of the rapid production and expansion of elastic fluids. The inflammation or explosion of gunpowder is a familiar example. See Chemistry.

DEUCALION was a king of Thessaly, who reigned about 1500 years before the Christian era, and it is supposed, in consequence of an inundation which overwhelmed the country, gave origin to the fabulous account of the flood which has been celebrated by the ancient poets, and holds so conspicuous a place in their mythology. According to the fable, he was the son of Prometheus, and he ruled his people with wisdom and equity; but the rest of mankind, being sunk in wickedness, were destroyed by a flood, while Deucalion and his queen Pyrrha saved themselves on mount Parnassus. The waters having subsided, the survivors of the human race consulted the oracle on the means of repeopling the earth, when they were ordered, with veiled heads and faces, to throw behind their backs the bones of their great mother, which, being interpreted, was understood to be the Earth, and her bones were supposed to be the stones; those which were thrown by Deucalion became men, and those which Pyrrha threw over her head were converted into women.

The story of Deucalion, which is veiled with poetical fiction and fable, is supposed by some to have derived its origin from the history of the patriarch Noah, and that the flood of Deucalion in Thessaly, of Ogyges in Attica, and of Prometheus in Egypt, were the same with that of Noah recorded in scripture. The classical scholar will find the account of Deucalion's flood, adorned with the embellishments of poetry, in the Metamorphoses of Ovid; and the English reader may consult with advantage Bryant's elaborate work on *Ancient Mythology*.

DEVIZES, a town of Wiltshire in England, stands on an elevated situation; the buildings are chiefly of timber, the population is nearly 4000, and the chief manufactures are broad cloth, serges, and kerseymeres, beside which a considerable trade in malt and corn is carried on by means of inland navigation.

DEVONSHIRE, a maritime county, in the south-west of England, lying between Cornwall on the S. E. and Dorsetshire and Somersetshire on the N. E., and washed on its northern and north-western coast by the Bristol channel, while the English channel bounds it on the S. and S. E. It is one of the largest counties in England, being about 70 miles long from north to south, and about 65 broad from east to west, and including an area of about 500 square miles, or 1,600,000 statute acres.

General appearance.—In its general outline it is irregularly four-sided, with its southern border much indented by numerous bays and inlets. The superficial features of the county are extremely diversified. The middle is hilly, and from the hills descend numerous streams which water the subjacent vallies, and, according to the soil, render one part on the southern coast a most fertile tract, teeming with luxuriant herbage and flourishing orchards, while the contiguous district to the north presents little but one barren swampy moss, fit for nothing but supplying fuel to the peasants; and the other districts on the northern side of the county partake of all the varieties of hill and dale, moorland and woodland, and exhibit scenery both romantic and picturesque.

Soil.—The soil of Devonshire varies considerably in different districts. Near the large rivers, especially in the neighbourhood of Cornwall, it is either boggy earth or loam, with a thin layer of mould; in the southern districts it is chiefly a red loam on a bed of yellow clay, and in the north it is a rich and fertile mixture.

Hills and rivers.—Though some districts of this county participate in the mountainous ridge that occupies so much of Cornwall, there is no part that rises to any very considerable elevation. What is called the forest of Dartmoor, the highest part, scarcely exceeds 1800 feet. In this district are scattered masses of granite of various sizes called *tors*, the principle of which are *Brent-tor*, *Sheeps-tor*, and *Dewer-stone*; and the first of these is remarkable for having a parish-church built upon its summit. Of the numerous rivers the chief are the Tamar, which separates this county from Cornwall, the Dart, the Ex, the Avon, all which fall into the English channel, and the Taw and the Torridge, which pour their waters into the British channel. None of these rivers has a very long course; but they possess the most interesting characters of mountain-streams; the current is clear and rapid, and the banks afford the most delightful scenery.

Canals.—As the rivers just enumerated are but ill fitted for the purposes of inland navigation, several canals have been projected, and a few carried into execution, viz. one from Tavistock to join the Tamar, another from Exeter to Crediton, a third from the same city to Cooley-bridge, and a fourth from Barnstaple to Topsham.

Climate.—Devonshire is supposed to have the finest and the most salubrious climate in England; for though, from its position between two seas and the hills by which it is intersected, the atmosphere is generally moist and showery, and bleak winds blow from the more elevated grounds of Dartmoor, the air of the vallies and of the southern coast is so mild that snow seldom lies, and myrtles and other continental shrubs stand the winter, and flourish in the open hedge row.

Natural history.—This county is not so rich in mineral productions as Cornwall; but this deficiency is amply compensated by its superior fertility in rare plants and valuable animals. In its mineralogy, Devonshire partakes of the adjacent strata both of Cornwall and of Somersetshire and Dorsetshire. On the east are seen the remains of that line of chalk, mixed with flints, which extends from Kent to Dorsetshire; and on the west, especially on the coast, thick strata of compact limestone make their appearance. Between these extremes are found granite, slate, green-stone, grauwacke, quartz, flinty pebbles, and sandstone. Among the limestone is found marble of so fine a quality as to render it an object of commerce; and gypsum is also procured in several places between Plymouth and Exeter. The sandstone obtained in Heavytree quarry, near Exeter, is well adapted to building, and makes good mill-stones; and much of the slate, especially what is called *holland-blues*, is of excellent quality. Many metals occur, (as lead, iron, copper, manganese, tin, silver, gold, antimony, bismuth, and cobalt,) but only the first four are obtained in sufficient quantity to repay the expense of mining. The richest lead mines are near Combe-Martin; and the galena sometimes yields more than 20 ounces of silver per ton. Iron ore is also found in the same neighbourhood, and bog-iron-ore in the moorlands. The principal manganese mine is at Newton-St-Cyres, from which nearly 200 tons are annually procured. Tin is no longer a staple commodity in Devonshire. A rich vein of copper is wrought near Tavistock; and cobalt, mixed with silver, is found near Stamford. Potter's clay, fit for brown earthen ware, is dug in the parish of Fremington; but, among the mineral productions of this county, the most singular, if that can properly be called a mineral which bears so complete a resemblance to vegetable charcoal, is Bovey coal, found in an extensive plain called Bovey Heathfield, in the vicinity of Exeter end, intermixed with the clay strata that divides the beds of coal, are found lumps of a bituminous resin, that burns with an agreeable aromatic odour.

No mineral waters of any note are found in Devonshire; and but few natural curiosities of the mineral kingdom. The principal among these last are, the *valley of stones*, a mile long, and about 300 feet broad, near Sinton, and some extensive caverns on the southern coast, between Torbay and Teignmouth.

So genial a climate must be expected to produce a great variety of plants; and accordingly, besides the species common in most parts of the island, are found several of great rarity, as *narrow-leaved flax, red valerian, ivy-leaved campion, vulpine lichen, umbellated hawkweed*, &c. Timber grows well in most parts of the county, except in Dartmoor, where there once appears to have been a forest, and in Bovey Heathfield, which must formerly have been covered with wood.

A native breed of horses, similar to those of the Highlands, is found here; and some of the cattle appear to be of the original stock. Game is abundant; and, among the fish which swarm upon the coast are found the *john-doree*, the *opah* or *king-fish*, turbot, pilchards, soles, mackerel, and the *torpedo*; and some of the rivers afford excellent trout. Oyster-beds of great extent help to supply the London market; and the shores on both sides of the county furnish specimens of some rare shells and zoophytes. The nightingale is very rare in this county. The *antiquities* of Devonshire are not numerous, and fall to be noticed under the towns to be presently described.

Population.—Within ten years, from 1801 to 1811, the number of inhabitants in Devonshire had increased nearly 30,000; the number in the former having been estimated at 354,400, and in the latter year at about 383,300, the females exceeding the males by about 20,000.

Divisions.—The divisions of Devonshire are partly natural and partly artificial. Naturally it is divided into five districts, North Devon on the Bristol channel, West Devon and South Hams stretching along the English channel, and Dartmoor and the vale of Exeter occupying the central parts of the county. The artificial divisions comprehend 33 hundreds, subdivided into 454 parishes and tythings, and containing 40 market towns, of which the principal are the city of Exeter, Plymouth, Tavistock, Dartmouth, Ashburton, Barnstaple, Tiverton, Oakhampton, Honiton, Plympton, Totness, Beeralston, all of which are boroughs,—Exmouth, Crediton, Biddeford, Axminster, Chudleigh, Cullumpton, Combe-Martin, Ilfracombe and South Molton.

Husbandry in this county is practised in all its principal departments of tillage, pasture, breeding cattle, and the dairy. The chief arable districts are the vale of Exeter, North Devon, and South Hams, and in the last of these great quantities of cyder are brewed. Wheat, barley, oats, turnips, and potatoes form the principal crops. The practice of paring the surface of pasture lands, and burning on the ground, is called from this county, where it is much employed *Denshiring*. The irrigation of meadows is used, but is not well understood. The best breed of cattle is reared in North Devon, and has been already noticed. The sheep called Exmoor, and the Dorsetshire breed, are most prized. One product of the dairy is almost peculiar to this county, and is called *clotted cream*, prepared by exposing new milk to a long-continued gentle heat till the cream rises thick to the surface. The cyder of Devonshire is considered inferior to that of Herefordshire, and is more apt to produce colic. Farms are usually small, and are held on leases of fourteen years, or for three lives.

Manufactures and commerce.—The manufactures are few, and consist chiefly of serges, long-ell cloths, iron articles, and cutlery goods. The cloths are sent to the East Indies. By the coasting trade, fish, cyder, and corn are sent to London and other ports, and groceries and other foreign produce imported in return, as also coals from the pits of Northumberland and Durham.

Devonshire, in its ecclesiastical relations, is included in the province of Canterbury and diocese of Exeter. It forms part of the western circuit; it sends 26 members to the House of Commons, including two for the shire and two for each of the boroughs above enumerated; furnishes 1600 men for the militia, and pays one-twentieth of the land-tax. Among the great landed proprietors rank several public bodies, as the sees of Exeter, York, and Salisbury, the duchy of Cornwall, the dean and chapter of Windsor, and the universities of Cambridge and Oxford. The roads are narrow, and in bad repair.

This county comprised, with Cornwall, the Roman *Damnonium*, and formed part of the province of *Britannia Prima*. Under the Saxons, it was included in the kingdom of Wessex. At Torbay, on the coast of Devonshire, King William III. first landed when he accepted the call of Britain to be the champion of its civil and religious liberties.

Of the towns noted as the principal in this county, Dartmouth, Ashburton, Barnstaple, Bideford, and Axminster, have already been anticipated under those heads. The rest are here to be briefly described.

Exeter, a city, and capital of the county, and the diocese, is situated in the hundred of Wonford, on the declivity of a rising ground on the eastern bank of the Ex. The walls by which part of it is surrounded form nearly a parallelogram half a mile long, and nearly as broad, having four principal streets crossing at right angles, and there is a gate at the south-west. A considerable space without the walls is occupied by buildings. The principal strees are well paved. Though the city is small it contains numerous public edifices; among which are, the cathedral, 18 other churches, several chapels, a Jewish synagogue, the bishop's palace, a sessions-house, a county gaol, an hospital, a lunatic asylum, a guild-hall, and a theatre. The cathedral is a large and magnificent building, of great antiquity, having been begun in the 10th century. It is ornamented with rich sculpture and large windows of stained glass, and contains an excellent organ, a curious clock, and a bell of enormous size. Near the cathedral, on the south-west, stands the bishop's palace;

and on the north-west, near the top of the hill, are the remains of Rougemont castle, a building which is traced to the Saxon period. There are also eight or ten public schools, and an infirmary for diseases of the eye. Over the Ex is an elegant stone bridge, and a custom-house on the quay, at which vessels of 150 tons burden can unload. Several important manufactories are carried on or completed in this city, especially that of various woollen stuffs and long-ells, the former of which, to the annual amount of L.500,000, are exported to the continent; and the latter, to the value of L.400,000, are annually sent to the East Indies. Exeter is the centre of an extensive wine-trade. The city is governed by a mayor, 24 aldermen, a recorder, a city chamberlain, two town-clerks, and a sheriff. It contains nearly 20,000 inhabitants. This city was known to the Romans, by whom it was called Isca. Distance from London 173 miles.

Plymouth, the second sea-port for naval rendezvous in England, is built on a capacious bay between the mouths of the Plym and the Tamar. It may now be said to consist of three ports, Plymouth properly so called, the streets of which are narrow, steep, and inconvenient; the *Dock*, or naval arsenal, with its numerous appendages, about two miles higher; and a suburb called Stonehouse, midway between these. Plymouth is fortified with ramparts, which form an interesting promenade, from which the delighful prospects in the vicinity of the town are seen to great advantage. The harbour of Plymouth has three compartments, *Hamoaze*, the mouth of the Tamar, which is the chief riding for men-of-war; *Catwater*, the mouth of the Plym, frequented both by king's ships and merchantmen; and *Sultan Pool*, confined to the latter. Besides the dockyards, warehouses, and storehouses at Dock, here are elegant marine barracks, a royal hospital, and two parish churches, with several dissenting meeting-houses. The place is well supplied with fresh water. It carries on an extensive trade, both foreign and domestic. Distance from Exeter 45, and from London 222 miles. Population about 43,000.

Tavistock, built on the river Tavy, was once a place of considerable consequence, and is still large and populous. It has a stone bridge over the river; and a clear brook runs through the street, supplying the inhabitants with abundance of water. Here is an iron foundry, and various articles of cutlery are manufactured The remains of a large abbey are still occupied as tenements. It is 82 miles from Exeter, and 206 from London.

Tiverton, on the Ex, on the borders of Somersetshire, is a handsome town, with a fine new church, and a stone bridge over the river. It was formerly noted for an extensive woollen manufacture. Here is a noble country-house, which once belonged to the Earls of Devonshire. The town has frequently been nearly destroyed by fire. Distance from Exeter 14 miles, from London 161.

Oakhampton stands on the small river Oke, 24 miles from Exeter, and 195 from London. It is remarkable chiefly for a castle and park belonging to Viscount Courtenay, and formerly to the earls of Devonshire.

Honiton is a place of more importance, both from its situation and trade. It is built on a gentle eminence, rising in a delightful valley, through which runs the river Otter; and its principal street has a rivulet flowing through it, and from this every house is supplied with water. Most of the houses are of recent date, in consequence of the repeated and extensive injury the place has received from fire. It has a church and chapel, three meeting-houses, a free school, and house of industry. It carries on an extensive trade in butter for the London market, and very fine lace and edgings are manufactured in the place. Population of the town and parish nearly 3000; distance from London 157 miles.

Plympton is a small place, though a borough and market-town, situated on the Plym, about seven miles from Plymouth, and 210 from London.

Totness, on the river Dart, stands on the declivity of a hill, and has a manufactory of serges. It is 27 miles from Exeter, and 196 from London.

Beeralston was made a borough by Queen Elizabeth, but is otherwise of no importance. It stands on the Taw, about 10 miles from Plymouth, and 211 from London.

Exmouth stands at the mouth of the Ex, on its north-eastern bank, about 10 miles below Exeter. It is a sea-port, with some trade, chiefly in fish, but is most noted as being a commodious situation for bathing. Behind the town are high hills, which shelter it from the easterly winds, and furnish rivulets of excellent water; and between the town and the sea are high cliffs which defend it on the south. Some good houses and an assembly-room afford good accommodation for visitors; and the walks and scenery in the vicinity are highly interesting. There is a chapel-of-ease to the parish church of Littleham. Population of the town and parish 4300.

Crediton, which is eight miles south-west of Exeter, was formerly called Kirkton, and was the see of the bishopric since removed to Exeter, and is still a flourishing manufacturing town, carrying on a considerable trade in serges. It has long ceased to be a borough, but is still governed by a chief magistrate called Portreeve. Like Honiton and Tiverton, it has suffered great losses by fire. Distance from London 180 miles.

Chudleigh stands W. S. W. of Exeter, at the distance of nine miles. The inhabitants are employed in the woollen manufacture.

Cullumpton, also employed in the manufacture of serges and other woollen stuffs, stands on the north of Exeter, and about 11 miles from that city, whither, as from all the neighbouring towns, the produce of its looms is carried. It is 159 miles from London.

Combe-Martin is situated on the Bristol channel, from which there is a small neck that admits large fishing-boats. Near this place silver mines, or rather lead mines unusually rich in silver, were formerly wrought, but the produce of silver is now small. It is 176 miles from London.

Ilfracombe, the principal sea-port on the northern coast of Devonshire, stands at the bottom of a rising ground that forms a semicircular ledge of rocks on the south, east, and west, while an insulated pointed rock, surmounted by a light-house, fronts the town to the north; so that a natural harbour, completely secured from storms, and capable of receiving ships of 230 tons burden, is thus formed. The place is much frequented by bathers, and carries on a good trade in conveying coastwise the produce of the county. It contains some good houses, has a well built pier, and a large plain church, with a handsome monument, and a population of about 2000. Distance from London 181 miles.

South-Molton stands on the small river Mael. A manufacture of woollen stuffs, principally serges, shalloons, and felts, is here carried on. The place is governed by a mayor. It is 180 miles from London.

It would be improper to conclude this brief outline of the topography of Devonshire without noticing its *scenery*, and those interesting objects which are seen from its commanding heights. The chief of these heights is Mount Edgecombe, near Plymouth, a seat which gives title to the earl of that name, and which affords a most beautiful and extensive prospect. Below the eastern front lies Plymouth sound, with its numerous shipping, and the craggy rock called Mewstone, which once formed a sort of prison; and not far off is Sattram, the beautiful seat of Lord Borringdon; while, from another terrace, the majestic and terrific Eddystone lighthouse is seen through a glass at the distance of four leagues, meeting the billows that foam around it. Stretching far to the east, the picturesque southern coast, with its frequent headlands, presents to the eye a long line of varied objects; and on the north flows the Tamar, whose banks afford a constant succession of rich scenery for many miles. The scenery from Rougemont castle at Exeter, though less varied, is highly pleasing, from the cultivated state of the surrounding country; and several other spots command views well calculated to repay the labour of the inquisitive observer. Besides the seats already mentioned, Powderham castle, near Topsham, a seat of Viscount Courtenay, and Lord Clifford's house, near Exeter, ought not to pass unnoticed.

DEUTERONOMY, composed of two Greek words, signifying *second* and *law*, is the last of the sacred books of the Old Testament written by Moses. It was composed in the 120th year of his age, and in the 40th year after the delivery from Egypt.

DEW is the condensed vapour of the atmosphere, which collects on all objects on the surface of the earth, and particularly on those which are the best conductors of heat. This process goes on chiefly during the night, when the difference of temperature is greatest.—See Chemistry and Meteorology.

DHALAC, or Dahalac, an island in the Gulf of Arabia, about seven miles distant from the east coast of Abyssinia, nearly 40 miles in length and 18 miles in breadth; and, excepting in a few spots, which afford a scanty subsistence to goats and antelopes, almost entirely destitute of herbage. No rain falls for nearly one-half of the year; and as springs are wanting, the water for the use of the inhabitants is collected in tanks or cisterns formed in the rock. Twelve villages, dispersed through the island, contain the greater part of the inhabitants, who are represented as a simple, inoffensive people, who subsist chiefly on fish, and carry on some trade with different parts of the opposite coast. The fishery of pearls, coral, and the tortoise, the latter for the sake of the shell, has existed from the remotest period of history, and it is still a profitable branch of industry.

DIADELPHIA, the 17th class of the Linnæan system of plants, in which the stamens are united into two parcels; and of which the common pea, *pisum sativum*; broom, *spartium scoparium*; and furze, *ulex Europæus*, are examples.—See Botany.

DIALECTICS, a term familiar among the ancient philosophers, and properly denoting that branch of logic which teaches the rules and modes of reasoning; but, in a more general sense, seems to have been applied to the peculiar systems of different sects.

DIALLING.

Introduction.

Dialling is the art of constructing sun-dials,—the art of forming an exact measure of time by means of the motion of the sun's shadow. The measurement of time is of such importance in society, that it must have occupied men's attention in the earliest stages of their advance towards improvement; and as the motions of the heavenly bodies, but more especially of the sun, afford the readiest and most obvious mode of accomplishing this object, the construction of the dial, being the first species of time-piece, is of the highest antiquity. Depending essentially on a knowledge both of geometry and astronomy, the art was cultivated by the most distinguished of the ancient mathematicians and astronomers; and though now almost superseded by the improved instruments of modern times, this ingenious contrivance formed certainly at the time of its invention an important gift of philosophy to the arts. The most ancient dial mentioned in history is that of Ahaz, who lived 720 years before the Christian era. The invention among the Greeks is ascribed to Thales the Milesian, or to his successor Anaximander, and by Pliny to Anaximenes; but, according to Herodotus, the Greeks derived it from the Babylonians. Vitruvius mentions a dial which was constructed by Berosus a Chaldean, who probably lived about 540 A. C. and in that case would be cotemporary with the Greek philosophers. So slowly did the Romans advance in the arts, that before the 460th year of the city no hours of the day were known but the rising and setting of the sun, and the period of noon, which was proclaimed by a herald when, from the senate-house, he saw the sun between the rostra and a place named Græcostasis. In that year, a sun-dial is said to have been erected by Papirius Cursor. Pliny doubts this fact, and thinks that the dial erected 30 years later, by Valerius Messala, was the first. Though very imperfect, this dial was the only one in use for 99 years, when Martius Philippus, the consul, set up a more exact one, which he had probably procured from Greece, to which the Roman arms had then penetrated. Since the revival of letters, the art of dialling has been much cultivated. Innumerable treatises have been written on it both scientific and practical; many of the former are distinguished for the elegant application of geometry; and the subject on the whole has been treated so variously and with such detail as to be now completely exhausted. But it is still an object of interest to the mathematician, and not without utility to the artist, as the dial is still employed to regulate the clock.

Dialling, like every other art, naturally divides itself into theory and practice. We shall endeavour, therefore, in Chapter I. to explain the General Principles; and, in Chapter II. to point out their Practical Application.

Chap. I. Theory of Dialling.

Sect. I. *General Principles and Definitions.*

Measurement of time.—As *space* is measured by continually repeating the same *body*, a foot or a yard for example, as a standard, so *time* can only be measured by continually repeating some constant *event*. The motion of a body, therefore, as it indicates by the spaces through which it successively passes a perpetual succession of events, is on this account well adapted for the purpose. For when we have got a body to move always either uniformly or in some determinate manner, we have then only to mark the spaces which it successively describes; these will point out the hours, minutes, &c. and measurement of time will thus be reduced to the simple problem of measuring space, when the body, like the hands of a clock, moving uniformly—describes equal spaces in equal times. We have only to divide the dial plate—the scale which measures its motions, into equal parts, and the successive arrivals of the index at each of those divisions will mark out a succession of equal intervals of time. But though the body, as is usually the case in dials, does not move uniformly over the dial-plate, though the hand of the clock, for example, were to move quicker in the first half hour than in the second, yet by accommodating our divisions to this unequal motion, by dividing the first half of the dial-plate into larger intervals than the second, the description of these would still mark out equal intervals of time, the increased velocity of description being balanced by the increased space to be described. Such then is the general principle of all time-pieces, of which the dial is the earliest application.

Style—Dial-plate—Hour-lines.—In his course through the heavens, from the morning to the evening of every day, the sun moves almost quite uniformly, and if we could apply, therefore, some scale to measure his motions,—if we could divide the sky into compartments, these motions would then indicate with exactness the hours of the day. But it is more convenient to estimate the motions of the shadows which he projects. While the sun moves from east to west, the shadows of all opaque objects move in the same regular manner from west to east. By dividing, therefore, the plane or surface on which any of these shadows fall into certain determinate portions, by thus forming a scale to measure the motions of the shadow, these divisions of the space, as the shadow passes successively over them, will mark out corresponding divisions of time; and such in general is the construction of every dial. It consists of a body to form the shadow, a surface to receive it, and on that surface a scale to measure its motions. The first is termed the *style*, the second the *dial plate*, or *dial-plane*, and the principal divisions on it, as they serve to mark out hours, are termed *hour-lines*. The dial-plate, as its name implies, consists generally of a plane surface. The style usually projects from the middle of this surface. It may therefore consist of a simple pin, as at Fig. 1. Plate 61. But it is more convenient to form it of a thin plate of wood or metal, s B S, Fig. 2. of which the short and parallel edges at *a b*, of the narrow face S s, serve to form the shadow *a b*, when the sun or light shines from C, Fig. 3. on the right of the style, and a b when from the left; while the base S B, Fig. 2. serves to fix more firmly the face S s, which cannot be kept too steadily in its position. This plate of metal may also have a lighter form, Fig. 4. or any other that the taste of the artist may incline; but the essential parts of it are the face S s, to form the shadow by its fine edges, and the base S B, to bind it to the dial-plate. Though this whole apparatus is usually called the *style*, the term in strictness belongs only to the face S s, or rather to each of the edges of that face, which forms the shadow; while the base S B, or rather the line of the dial-plate on which this base rests, is called the *substyle*, or *substylar line*, that is, the line which is directly or perpendicularly under the style. In some dials, however, the style, instead of thus springing from the dial-plate, is entirely detached from it, is equally raised above it at both ends, and is thus quite parallel to it. In these cases, the plate which forms the style becomes rectangular, as at Fig. 5. instead of triangular as at Fig. 2.; or it may be formed as at Fig. 6.; still lighter, as at Fig. 7., or according to any other ornamental design. The dial-plate is either round, as at Fig. 26. Plate 62. square, as at Fig. 27. oblong, as at Fig. 28. or any other convenient form. The hour lines are marked in a compartment along the circumference; the intermediate spaces are divided into quarters, or even minutes; and the interior is reserved for tables for correcting the watch or clock, or other convenient notices connected with the reckoning of time in the motions of the sun.

Sect. II. *Of the Style.*

Motions of the shadow.—Such are the principal parts of a dial; and the whole art consists in erecting the style in a proper position, and dividing the dial-plate in a proper manner,—accommodating its hour lines to the various motions of the shadow. These motions of the shadow depend obviously on those of the great luminary by which it is formed; and it is clear that, in order always to indicate the same hours, they ought to be every day exactly the same. But the motions of the sun are very far from being the same. Every succeeding day, indeed, he takes a different route through the sky. In our latitudes, and in the middle of winter, he scarcely rises, even at the highest, more than 10° above the horizon, and traverses but a very limited portion of the heavens; while, in the middle of summer, again, he rises at mid-day nearly six times as high, and, at the same time, with a proportionally wider range from east to west. From these extreme limits on the north and south, he passes insensibly through all the intermediate gradations. From the middle of winter he advances towards the north, ascending at mid-day to a greater and greater altitude, until the middle of summer, when, after a short interval of rest, he returns again in the same regular manner, descending by successive steps from the high meridian elevation he had attained, and contracting also every day the extent of his range. Arrived at the point from which he set out, he again, after a short interval, begins to re-ascend as before, and to repeat the same series of changes. Now, as the shadow of the style, in its course over the dial-plate, must necessarily follow all these variations of the sun in his course through the heavens, some corresponding variation in the form or construction of the dial would seem necessary to make it still indicate the same hours. In some dials, accordingly, the style itself is, for this purpose, moved into a new position from day to day, or only from month to month; and these are termed dials with *variable centres*. It was a happy idea, therefore, so to arrange matters, that the dial should point out the time with accuracy throughout the whole year, the style and every other part of it remaining quite fixed; that the shadow, quite insensible to the sun's annual motion, should yet follow with exactness all the variations of his diurnal motion. This object is accomplished in a manner equally simple and ingenious. It consists in giving to the style a determinate form and position; and, accordingly, in all the variety of this kind of dials, it is a universal principle, that the edge of the style must be a *straight line*, and that this line must *point towards the pole of the heavens*. Whatever be the situation or form of the dial-plate, whether it is plane, spiral, or any how curved, whether horizontal, upright, or inclined toward the north, south, east, or west, the position of the style remains invariable.

Motion of the sun.—The necessity of this determinate position of the style arises from the sun's peculiar motion. On following with attention his various positions throughout the day and the year, we find that the above described motion, which seems to carry him not exactly from east to west, and much less so from south to north, or from north to south, but in some intermediate direction, which is also not exactly the same from day to day, or from month to month, but is only repeated from year to year,—we find that this motion may be viewed as compound, and as the joint effect of two simpler motions, one of which is exactly repeated every day, and is therefore termed the *diurnal*, while the other only finishes all its variations and again begins the series in the course of a year, and is accordingly termed the *annual* motion. Our object, therefore, in order to make the dial indicate the same hours every day, is to separate these motions in reality,—to resolve the compound into its elements, and, exposing the shadow of the style to that one which is repeated from day to day, to destroy at the same time the effect of the other, which, varying throughout the whole year, would require a particular set of lines or some corresponding variation in the dial for every particular day.

Positions of the shadow.—For this purpose it must be observed, that though the shadows of objects move with the light by which they are formed, there are yet certain motions of the light which have no effect whatever on the shadow. If a candle, for example, be moved to the right or left of any object, or if it be moved up and down, the shadow on the wall moves, no doubt, always in the opposite direction; but if the candle be moved only straight forward to the object, or backwards from it, the shadow will remain quite immoveable.

Of a point.—In short, the shadow of the point T, Fig. 8. illuminated by the light C, is always in the continuation of the line C T which joins them together; when projected on the wall A B, Fig. 9. is always at t in the continuation of the line *which joins the illuminating to the shading point*. As long, therefore, as the light C is only moved backwards or forwards to the point T,—as long as it continues in the line C T,—as long as the illuminating describes relatively to the shading point only *linear*, and no angular distance, the shadow will remain quite immoveable. But whenever the light moves to the right hand at *c*, or to the left at c,—whenever the successive positions c *c* form at T an angle C T *c*,—whenever the illuminating describes, relatively to the shading point, any *angular* distance, then, and then only, does the shadow begin to feel, as it were, the motion of the light, shifts its position to *t*, and describes the angle t T *t* exactly equal to C T *c*, the angle described by the light.

Of a line.—But the shadow of a line remains unmoved under a much wider range in the motion of the light. If a thread, R T S, Fig 10. be suspended from the ceiling B, its shadow on the wall will move as before, from right to left, or from left to right, according as the light is carried in the opposite direction; in like manner it will not be in the least affected by making the light either advance or recede, but it now also remains as immoveable when the candle is either elevated or depressed. The shadow of the part R T S, will fall on r t s, and although the candle be moved to C or *c*, the shadow of R S will still fall on the point t. In short, to speak with the brevity, and, at the same time, with the precision of geometry, the shadow of the line R T S, will be in the continuation of the *plane* R C S T, which joins it to the light C. As long, therefore, as the light continues in any part of this plane, the shadow of the line, supposed indefinitely long, will remain quite insensible to any motion which it may perform.

Form and position of the style.—Let us form the style then into a straight line, such as R S, Fig. 10. and its shadow will not be in the least affected with any motion which the luminary may have in the direction of the plane which joins it to that line, but only with the motion which is perpendicular to that plane. Now the annual motion of the sun above described, and of which we wish to destroy the effect, is performed entirely in the plane which joins the luminary with the axis of the earth and of the heavens—with the line which, passing through the earth's centre, joins the two celestial with the two terrestrial poles; while the diurnal motion again, which we wish to retain, is performed entirely at right angles to this plane, and is that with which the sun and all the other heavenly bodies are carried, as if by one impulse, round this common axis. The earth also is so small, in respect to the celestial sphere and the distance of the sun, that its magnitude may be entirely overlooked; and though we are really operating at the surface, we may still on this account be considered, without sensible error, as erecting our dial at the very centre. Hence it is evident, that if we direct the edge of the style to the pole of the heavens, and thus make it coincide with the imaginary axis round which the diurnal motion of the sun and of the sphere is performed, then the sun's annual motion will no more affect the shadow than if it had no existence.

Illustration.—To illustrate this by a diagram, let P E, p Q, Fig. 14. represent the celestial sphere, in the centre, O, of which the earth is conceived to be situated; then we know from astronomy P. that the diurnal motion of the sun is exactly represented by supposing him attached to this sphere, suppose at the equator at Q, and carried along with it round the axis P *P*, in the direction E O Q, and that the line E O Q will be a section, and will represent the diurnal circle which he that day describes, and which, if accurately exhibited, would rise above the paper on the one hand, and sink below it on the other, in the same manner as P Q p E rises above e Q at P, and falls below it at p. Conceive now P p an opaque axis, and it will then obviously, as the sun moves along E O Q, cast behind it a shadow, which will move in the opposite direction; while the hemisphere P O p Q, therefore, is quite transparent, let the other hemisphere P O p E, be formed of some hollow opaque body to receive this shadow; then it is clear that if the sun is at Q, the shadow of P p will fall in the semicircle P E p, which is in the continuation of the plane that joins Q to P p; and also that, as the sun advances in the direction E O Q, that is, as he sinks under the paper to any point A, the shadow will in like manner rise above the paper, and fall now on the circle P *a* p, of which the point *a* is as far from E as A is from Q, and that as the sun advances to the points B C D E, equally distant from each other, the shadow will fall successively on the equidistant semicircles P *b* p, P *c* p, &c. Suppose now, however, that the sun in his annual advance towards the north pole has arrived at his tropical limit at T or at R, then the line T R will represent, as before, the diurnal circle which he describes that day; and it is obvious that while he is at R, the shadows of P p will still fall on P E p, the same as if he had been at Q, and that as he sinks successively to the points *A B C*, &c. the shadow will, in like manner, as before, rise successively to the semicircles P *a* p, P *b p*, &c. as if the sun had been at Q, and descending to the points A B C, &c. In short, it is clear that this change in the sun's position will have no effect whatever in the motion of the shadow of P p. But it would be easy to shew, that it is only in this peculiar motion of the style that the desired effect would obtain; that the shadow of any other line, O Z, for example, would greatly change its motions, in consequence of this new position of the luminary which forms it, would vary indeed every day as the sun varied his course in the heavens, and would therefore be quite unfit for indicating the time, without some auxiliary operation. This may be still farther illustrated by placing on the middle of a table an upright stem, and beside it one which is inclined, then forming a shadow of each by a candle or lamp which can be moved up and down on a stalk. It will be observed, that as the candle is elevated or depressed the shadow of the upright stem will remain immoveable, while that of the inclined will change its position with every motion of the light. In the same manner, while the sun oscillates from tropic to tropic, the shadow of any line parallel to the axis of the world remains quite immoveable, while that of every other follows all his variations.

Elevation of the style equal to the latitude of the place.—Since the style then must always point to the celestial pole, it must necessarily be elevated above the horizon of the place exactly as much as the pole itself. But the pole is variously elevated in different parts of the earth. It rises, as we advance, northwards from the equator, where it is scarcely visible, and it sinks again in like manner as we return. The style of the dial, therefore, in its elevation above the horizon of the place, follows strictly all these variations, and is not the same for any two places north and south of each other. At the pole it is perpendicular to the horizon; it will there stand upright from a horizontal dial; at the equator it will be perpendicular to it; and on the horizontal dial will have the form at Figs. 5, 6, 7; and throughout the intermediate places it will have all the intermediate degrees of elevation. But, since the elevation of the pole above the horizon of any place, as is well known in astronomy and geography, is always equal to the latitude of the place,—since the distance of the pole from the horizon, expressed in degrees, is exactly equal to the distance of the place from the equator expressed in degrees, hence the style's elevation above the horizon will always be determined by the latitude of the place which it will thus constantly equal.

The style of every dial, besides being thus elevated, is also necessarily situated in the plane of the meridian,—in the plane which passing through the pole and through the axis of the earth thus points due north and south as the position of the meridian, is easily found by a method to be afterwards described. This additional circumstance completely determines the situation of the style for any part of the earth; for we thus know the position of the place in which it is situated, and also its elevation in that place.

Sect. III. *Of the Dial-plate.*

Form of the dial-plate.—Having thus ascertained the form and position of the style, we shall now consider that of the dial-plate. We have already seen that the angle t T t, Fig. 9. which the shadow describes, is exactly equal to the angle C T c, which the light describes, or, in general terms, that *the angular motion of the shadow is invariably equal to the angular motion of the light*; and it is on this simple and obvious principle that depend all the methods for constructing the hour lines on the dial-plate.

But, though the *angular* motion of the shadow round the shading point depends thus entirely on that of the light, its real motion along the surface on which it falls will obviously be modified by the form and position of this surface, or dial-plate. When the light in Fig. 9. moves from C to *c*, the shadow on A B moves from t to *t*, or describes the angle t T *t*, and the line t*t*; but if A B be considerably farther off, as in Fig. 11. though the angle t T *t* be still the same, the line t *t* is considerably longer in proportion to its greater distance from T, and if it had been nearer T the line t *t* would have been shorter. If the surface A B be not straight, as in Fig. 9. and 10. but circular as in Fig. 12. waved as in Fig. 13, or curved in any other manner, then, though the angular motion of the shadow remain the same, though it still describes the *angle* t T *t*, its line or motion will vary according to the figure and distances of the surface which is presented for it to fall on. According as it is projected on the surface A B, Figs. 9. 11. 12. 13. it will describe the various lines t *t*, Figs. 9. 11. 12. 13. mounting in the latter to every elevation and sinking into every depression. The shadow of a line is capable of still greater variations; and though there be any number of dials, therefore, all exposed at the same place to the sun, and having all their styles pointing to the pole, yet, if the form or position of their dial-plates are different, the motions of the shadow along them will in like manner differ in each. But, as each of them will still be consistent with itself, as it will exactly repeat its own motions every day; and as it is always possible to accommodate our divisions of the hour lines to any species of motion in the shadow whatever, it is hence obviously of no consequence what form or position we give to the dial-plate. This then is the reason of the immense variety of dials which have been described and constructed. The position of the style being the same in all, they are distinguished by that of their dial-plates.

Sect. IV. *Of the Various Kinds of Dials.*

Some dials look directly upwards to the heavens; and as their dial-plates are thus quite level, they are termed *horizontal* dials. Some again directly front the south, the north, the east, the west, or any other point in the compass. These, in general, as their planes are all vertical or perpendicular to the horizon, are termed *vertical* or *erect* dials. Those of them which are turned to any of the cardinal points, are termed, besides, *direct*; while the others, which are turned to any of the subordinate points of the compass, which thus deviate or *decline* from the cardinal points, are termed *declining*. But all the vertical dials are occasionally named simply by the directions to which they look. Thus, a vertical direct, or an erect direct dial, fronting the south, is termed simply a *south* dial. A vertical dial declining from the south four points to the west, and thus fronting the south-west, is in like manner termed shortly a south-west dial. Other dials slope towards the south or the north, while their planes are neither vertical nor horizontal; they yet point due east and west; these are termed *reclining* dials, or sometimes *proclining*. Lastly, some dials whose planes are neither vertical nor horizontal, nor yet do they point due east and west; are termed *declining-reclining*. They are the most complicated of all in their position, and therefore the most difficult to construct.

Illustration.—Let A B C D, Fig. 15. represent a horizontal plane, in which N S is the line of north and south, and E W that of east and west. A dial described on this plane will be a horizontal dial; and as at the same place on the globe there is but one horizontal plane, so there is for that plane only one kind of horizontal dial. Conceive now the plane A B C D, to turn round the east and west line E W, Fig. 16. and to assume successively the various positions a b c d, *a b c d*, a′ b′ c′ d′, &c. Then, as notwithstanding of its continual motion it still keeps steadily pointing towards the east, it will thus clearly exhibit all the possible variety of *reclining* planes, from those which have scarcely any elevation towards the south, to those, on the other hand, which have scarcely any elevation towards the north; and a dial inscribed on each of them, would therefore, in like manner, exhibit every possible case of the *reclining dial*. As the plane A B C D rises above the horizon as it advances, in Fig. 18. from H O, which represents a section of the horizon towards the zenith Z, there is evidently one point of its course where it will coincide with the equator E Q; and, in this remarkable situation, which occurs when the plane has the same elevation with that of the equator, the reclining dial, which would then be inscribed on it, is termed the *equinoctial* dial. It is the simplest of all dials. As the plane continues to rise, it will at last arrive at the zenith Z, in the position Z z. It will then be a vertical plane, looking towards the south on the one hand, and towards the north on the other. In this second peculiar position, therefore, the inscribed dial will be a vertical south one on the one side, and a vertical north one on the other. Let the plane however still turn in the same direction, and in its progress downwards it will evidently coincide with the axis of the sphere P p; and, in this third principal position, as the dial is here also equally distinguished by its peculiar properties, it is termed a *polar* dial.

But suppose now that the plane A B C D, instead of proceeding in its course after it has arrived at the zenith Z,—that instead of turning onwards on the axis E W, Fig. 15. and 16. it stops short, and turns on the axis Z z, Fig. 18. perpendicular to the former,—assumes successively the various positions A B C D, a b c d, *a b c d*, &c. Fig. 17. then we shall

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have all the variety of *vertical* dial-planes, direct and declining. Suppose, again, that the plane A B C D, Fig. 15. turns, not upon the axis E W, but on any other *e w* inclined to the former by the angle E O e, we shall then have a series of planes, all of them declining from the south towards the east, by the constant angle E O e, and at the same time assuming all the various degrees of *reclination*, from the most gentle slope towards the south, to one equally small towards the north. Assuming any other line, *n s*, for an axis, we would have the same series of reclinations, with a different declination, and assuming successively all the axes from E W to N S, we would at least obtain all the varieties of declination, as well as those of reclination; and exhausting, in this, regular manner, all the possible positions of the plane A B C D, we thus obtain a correct idea of all the possible varieties of plane dials. The declining-reclining, as they are the most complicated in their position, are in like manner the most difficult to construct; and, in their vast variety, we have a very good illustration of a compound, which is determined by *two* variable elements instead of one, how enormously the number of its various cases are increased.

It is curious and important to remark, that all these variations in the situation of the dial plane, which determine the various kinds of dials, and which occur when, on the same part of the earth, we incline it variously to the heavens,—that they all occur likewise in the same order, when, keeping the whole instrument steadily in its position towards the heavens, we transport it in this manner over various parts of the earth, when we keep the style constantly directed to the pole, and the dial-plate fixed immoveably to the style, whether perpendicular to it or anyway inclined. When we keep the whole instrument thus parallel to itself, it will become a horizontal dial at one part of the earth; a vertical at another; a reclining at a third; a declining-reclining at a fourth; and at the intermediate spaces will go through all the intermediate varieties, as is evident from Fig. 19. where P E p Q represents the earth, and A a horizontal dial in the latitude of Edinburgh, which becomes a vertical one 90° to the south at B, a reclining at C, a declining at D, and a declining-reclining at E. Hence it appears, that a horizontal dial constructed for Edinburgh will shew the time at any other part of the world, if it be properly set; that a declining or reclining dial for Edinburgh will be a horizontal dial for some other place; and that therefore the construction of all the varieties of dials in Edinburgh may be reduced to that of a horizontal dial for different latitudes,—a circumstance which, as we shall afterwards see, introduces considerable simplicity in the operation.

SECT. V. *Position of the Style relative to the Plane of the Dial.*

Though the style remains quite immoveable amid all those variations in the position of the dial-plate, it must still obviously change its position in respect to this plane, which is continually moving relatively to it; and being, as we shall afterwards see, a capital object in the construction of dials to determine this position with exactness, we shall here consider it a little more particularly.

Elevation of the style.—When the plane A B C D, Fig. 15. is in the horizon, as at H O, Fig. 18. then the style, which invariably coincides with P p, will be elevated above the plane of the dial by an angle equal to o O P; in proportion, however, as the plane rises towards Q, it at the same time withdraws itself from the style O P, which will thus become more and more elevated above it. At *a*, the elevation will be *a* O P, having received an addition, *a* O o, exactly equal to the height H O a, by which the plane has elevated itself above the horizon; and when the plane coincides with the equator E Q, that is, in the case of the equinoctial dial, the elevation of the style is the greatest of all, P p being then perpendicular to E Q. As the plane continues to rise, the style P o still rises in like manner; but as it now approaches the other side of the dial, the elevation above this gradually diminishes; at b, the elevation is strictly *b* O P; but as the style P O is now nearer the side b O than *b* O, the elevation is rather measured from that, and is reckoned equal to P O b, the supplement of *b* O P, and not to *b* O P itself. At Z z, in the case of the north and south dial, it is equal to P O Z, (which is obviously the complement of P O H, the elevation in the horizontal dial;) and at P p, in the case of the polar dial, it vanishes altogether, the style being then parallel to the plane of the dial, and this being one of the cases where it has the form Figs. 5. 6. and 7. As the plane still descends, the elevation of the style again increases, and at H it is the same as before. Thus it appears, that as the dial-plane, in the case of reclining dials, rises above the horizon, the style rises as regularly, and by the same gradations, above the dial plane at one time, and approaches it at another; and hence the style's elevation above the plane is connected by a very simple relation with that of the plane and of the pole above the horizon.

In the south vertical dial, Z o z, we have seen that the elevation of the style is equal to Z O P. Conceive the plane to turn round Z O z, in the direction H O o, and the elevation of the style will gradually diminish until the plane at last, in the case of the vertical east and west dial, coinciding altogether with that of the meridian P Q p E, when this elevation will also entirely vanish, and the style, as in the polar dial, will become quite parallel to the dial-plate. As the plane continues to turn, the style will again begin to elevate itself above it, until it again returns to its first position Z z, when the elevation will be again Z o P, and from which limit it will again begin to diminish as before. Hence, it appears, that in vertical east and west dials, the elevation of the style is nothing, while in north and south dials it is equal to, and can never exceed the angle Z O P, the distance of the zenith from the pole, which is obviously the complement of the pole's elevation above the horizon. Between these limits the style's elevation varies by regular gradations; but its value in any case cannot be determined by a rule so simple as that for the dials of the reclining order. We shall, therefore, defer the farther consideration of it to Chap. II. as also that of the position of the

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Sect. VI. *Of the Hour Lines.*

Hour circles.—Proceeding from the plainest principles, we have seen how the style of every dial must point towards the face of the heavens, and having found that the direction of the dial-plate is perfectly arbitrary, we have considered the various characters which it may assume,—we have determined the direction of the style relatively to a spectator on the earth, and shewn how it varies relatively to the various inclinations of the dial-plane. Thus prepared, therefore, let us now consider how the hour lines of these various dials are to be determined; the position of these depends entirely on the motion of the shadow of the style—this upon the diurnal motion of the sun,—and this motion is exactly represented, as we have seen by the diagram, Fig. 14. already described. Conceive, then, the sphere P E p Q, with all the circles described in it, P A p, P B p, &c. to remain at rest, and the sun to move over each of them successively in his diurnal course from E to Q, or from T to R; then it is clear that since the sun completes his daily revolution in 24 hours, the period of the day, since he moves from E to Q in 12 hours, and from Q back again to E in 12 hours more, it is clear that if we divide the hemisphere into 12 equal parts by the circles P A p, P B p, &c. drawn at right angles to E Q and T R, the direction of this motion, the sun will arrive on each of these circles every successive hour; these circles thus diverge at intervals from the poles, and divide in imagination the celestial sphere into 24 equal compartments, and are hence termed *hour circles* of the sphere. They are each obviously separated from the other by 15°, the 24th part of the whole circumference of 360°, in the same manner as one hour is the 24th part of the whole day.

Hour lines of a hemispherical dial.—Let Pp, Fig. 14. then as before be an opaque axis; P E p O, an opaque hollow hemisphere to receive its shadow, and inscribed within with the circles P e p, P a p, &c. to measure its motions; and, lastly, let the upper hemisphere PQp O be transparent, to let the light pass,—then it is obvious that as the sun every hour arrives successively on the circles E D C, &c. the shadow will in like manner every hour arrive succesively on a corresponding circle, P e p, P d p, &c. and that as P E p, &c. are the same circles of the sphere, so P e p, P d p, &c. will be the hour lines of a *hemispherical* dial P E p O.

Equinoctial dial.—But this globular form is not convenient; let the shadow of P O, therefore, fall not on the curved surface P E, but on a plate situated in the plane of the equator E O Q, and of which E O Q, Fig. 20. is a front view, the style P p standing perpendicularly from the centre. Then it is evident that, as the hour circles of the sphere divide the equator E O Q, Fig. 14. into 24 equal parts, Q A, A B, &c. and of which only one half is observed in the figure, so the shadow of P p, Fig. 20. will fall upon such points every hour as if noted would divide the circumference of the dial-plate also into 24 equal parts. When the sun from Q arrives at A, the shadow will advance from XII to I.; the sun at B, the shadow will be at II; and such will be the hour lines on the dial-plate, E B A Q, of an *equinoctial dial.*

Theory.

Horizontal dial.—Suppose now the shadow is received upon any other plane, such as the plane of the horizon, for example, in lat. 45°, and that we wish to find how the hour lines arrange themselves on that plane so as to form a horizontal dial for that latitude, Let H O o, as before, Fig. 21. be a section of the sphere by the plane of the horizon of lat. 45°, the horizontal circle which circumscribes the sphere at the distance P o of 45° from the pole P, and which is more distinctly drawn at Fig. 22; then the question always is, in what manner is this circle divided by the hour circles P a p, P b p, &c. of the sphere, for exactly in the same manner will the circumference of the dial-plate be divided by the line of the shadow every hour. The equator, E Q, as we have seen, is divided by these circles into equal parts; but it is obvious from inspection that H O o is divided unequally, and the exact proportions in which it is cut are very distinctly observed in a common terrestrial globe.

By the globe.—Elevate the pole to the latitude P O, then will the wooden horizon represent the circle H O o; and if one of the meridians be brought directly under the brazen meridian, then the points where the hour circles, P a p, &c. coincide with the horizon, will be clearly perceived; and as the wooden horizon is divided into degrees, beginning from O, it will be easy to read off the angular distances O a, o b, &c. Draw now any circle, O e, Me, Fig. 23.; lay off, on its circumference, and from any point, O, the same series of distances, o a, o b, o c, &c.; this found, join these points with the centre O, and the lines O o, O a, O b, &c. will be the hour lines of the dial; O o being that of XII, because the shadow of P o, Fig. 20. falls always on O, when the sun is at Q, and Q is in the plane of the meridian, on which the sun is always situated at mid-day.

In the same manner, by means of the globe, may the hour lines for any other dial whatever be determined; for, if it is a vertical dial, whose plane is represented by Z O z, Fig. 21. we have only to bring this circle to the wooden horizon, and read off the degrees as before; or it may even be done by screwing the quadrant of altitude at Z, and laying it over the globe in the direction Z O; or, if it is a reclining or declining dial, as M N or m n, laying the quadrant always in the line M O N, m o n, of its reclination or declination.

Without the globe.—But the hour lines can be determined by a very general and more accurate method without the globe. The equation, E Q, Fig. 21. is divided, as we have seen, into equal parts, by the lower circles of the sphere; and the circle H O, Z z, M n, of every other plane, is evidently divided unequally. But it appears, on inspection, that Z O, though differently divided from Q o on the one hand, and from N O on the other, is yet divided exactly, as O o; now Z o and o O are both equally distant from P O, P O Z being equal to P O o. Again, N O and M O, though both differently divided, either from Z O or Q o, are still exactly like each other; but they are also equally distant from P O, P O N being equal to P O M. Hence, it appears, whether a plane be vertical, horizontal, or any how inclined, provided its distance from P O remain the same, the hour lines will assume upon it the very same arrangement. *The elevation of the style above the dial plane*, then, is the great and only element which determines the position of the hour lines, whether the dial be horizontal, vertical, or any how inclined; and this agrees well with what we have already remarked, that a horizontal dial at one plane becomes a vertical at another, a declining at a third, and so on. The question then is, how are the hour lines to be determined, when we know the elevation of the style. This is done in a very simple manner. When the style is elevated 90° as in the equinoctial dial, the hour lines are all at equal distances, as in Fig. 20. or Fig. 24. Let A B C D now be a plane perpendicular to that of the equinoctial dial, E P G H, then the style O p will have no elevation above the plane A B C D, but will be parallel to it, and will thus become the style of a polar or east or west dial. Produce the lines P 12, P 1, &c. to meet A B C D, and the lines of section XII, I, II, &c. will evidently be the hour lines of that dial, which will thus arrange themselves parallel to each other, as in Fig, 28. and at the distances from XII, of XII I, XII II, &c. respectively. But these distances are the tangents of the hour angles, 12 p 1, 12 p 2, &c., that is, of 15° 30°, to 45°, &c. to the radius p XII. The construction of these kind of hour lines, therefore, is obvious.

Let E u, Fig. 25. represent the same equinoctial dial in an oblique position, and let the hour lines be produced to the points a b c, &c. in the line A B; let B D also be the plane of any other dial having the same style, P p; then it is obvious that, if we join the lines p a, p o, p c, &c. these will be the required hour lines of the dial. But in the line A B, the distances a b, a c, a d, &c. are evidently the tangents of the hour angles, 12 P 1, 12 P 2, &c. of 15°, 30°, 45°, &c. to the radius P a; P a is also clearly the sine of the angle, a p P, to the radius ap; and the angle, a p P, again is the elevation of the style above the dial-plate, the element which is given to determine the question. To find the hour lines, then, on any dial plane in which we know the elevation of the style, we have only to draw a line, A B, divided from the point *a* on each side, according to the tangents to any radius, of the angles 15°, 30°, 45°, 60°, &c. quantities which are easily obtained, as we shall shew from tables or lines of tangents. Then from a draw a D perpendicular to A B; find a second radius to which the first is the sine of the style's elevation, (which is also easily accomplished;) make a C equal to this radius, and C will be the centre of the dial; join now C b, C e, C d, &c. and these will be the hour lines. This rule is extremely simple, and applies to all dials whatever. Having thus determined the hour lines, it then becomes a question, which is the hour line of XII? This we shall consider in Chapter II., as also how to determine, in all cases, the style's elevation; our object in this first chapter having been merely to point out the general principles and mode of proceeding.

Chap. II. Practice of Dialling.

Sect. I. *Of the Instruments used in Dialling.*

Hour angles.—The practice of dialling consists of two distinct operations,—the formation of the dial-plate and style, and the erection of the instrument, thus finished, in its proper position. In forming the dial-plate, the principal object is the description of the hour-lines, placing them at the proper distances, XII. I. I. II. II. III. &c. Fig. 26. from each other. But were we to measure their distances along the circumference of the dial, they would evidently vary according as this circumference is round, as at Fig. 26. square as at Fig 27. or in any other form. To obtain a measure of the hour distances, independent of their variations, we must consider next the linear distances XII I, XII II, &c. Fig. 26. Plate 62.; but the *angles* XII c I, XII c II, &c. these are termed the *hour angles* of the dial. Like all other angles, they are measured by the parts *a b*, *a c*, *a d*, &c. which they cut off from the circumference of a circle, or part of a circle, *a b c d*, drawn from the centre C. For this purpose, to obtain a uniform and intelligible scale for these measurements, it has been agreed to divide the circle into 360 degrees, marked thus, 360°; and to subdivide each degree into 60 minutes, marked thus, 60′; and so on. And whatever number of these 360 parts of the circumference is contained in the portion between the two radii *c a*, *c b*, the angle *a* C *b*, or XII c I, is said to be an angle of so many degrees; and if so many minutes more, it is not an exact number of degrees. When we have found, therefore, by the methods afterwards to be described, the number of degrees in the angles XII c I, XII c II, &c. by their describing a semicircle from the centre C, and dividing it into degrees, it is easy in this manner to find the points to which the hour lines from the centre ought to be drawn; and from these points they can then be produced to the compartment intended for the hours, whatever be the form of this circumference, whether square, round, or anyhow curved. Since the laying down of angles becomes thus a capital operation in dialling, and since it would be both inaccurate and laborious to divide always the circumference into degrees, it is necessary to be acquainted with the instruments, and the more expeditious methods that have been contrived for this purpose.

The Protractor.—The protractor is a brass or ivory circle, or semicircle, similar to a b c d, Fig. 26. accurately divided into degrees. To lay off an angle with it, as for example a line, A C, Fig. 30. making an angle of 20° with A B, having the centre of the semicircle on A, and its edge on A B; then mark the paper at the point *a*, opposite 20° in the protractor; join now A a, and produce it to C: C A B is an angle of 20°. In the same manner, any angle, C A B, already laid down, may be measured by the protractor. Instead of being semicircular, it is also sometimes rectangular.

Line of chords.—The line of chords is a divided line on mathematical scales, represented at Fig. 31. To lay off an angle by it, as suppose a line A C to make an angle of 30° with A B, stretch the compasses from o, on the line, to the division 60°; with this distance, which is the chord of 60°, and equal to the radius of the circle, describe an arch of a circle b a d. Stretch again the compasses from o to 30°, and lay off this distance from b to a; join A a, produce it to C, and C A B is the angle required. By reversing this process any angle may be measured.

Line of tangents.—The line of tangents is also a line on the scales by which the tangents a b, a c, a d, &c. of the angles a C b, a C c, &c. may be laid off; the tangent of 45° in the line being equal to the radius C a of the circle to which the tangent corresponds. In the same manner, the *line of sines* is a line for laying off sines, and so of the other lines.

The sector is also an extremely useful instrument in all these operations, and there are sometimes on it, and generally on the common scales, two lines expressly for the purposes of dialling. The one is named the *line of hours*; it is represented at Fig. 31. and is merely a line of tangents for every 15°, for the hours, and their intervals subdivided into minutes. The other is called the *line of latitudes*, and is also represented at Fig. 31. which shews how these different lines are constructed. For the line of chords the quadrant A B is divided into 90 equal parts; and the chord of each degree, as A 10, 10, 20, &c. is transferred to the chord of 90° A B, which then forms the required line. In the line of sines, divide the quadrant D C into 90 equal parts; and from each degree draw perpendiculars to C E, 10, 10, 20, 20, &c.; E C will then be a line of sines. For the line of latitudes, divide the quadrant C D into 90 unequal parts, by drawing from the point D, through each degree of the line of sines in succession, the lines D 10, D 20, and all the intermediate ones; transfer the chords B a, B b, &c. to B C, and B C will be a line of latitudes. For the hours, draw E G 3 perpendicular to the chord A D and r s parallel to it, and touching the circle in 3.; divide D A into six equal parts, D 1, 12, 23, &c.; join E D, E 1, E 2, &c. and produce them to meet the tangent in the points XII. I. II. III, &c.; r s will then be a line of hours. And if D 1, 12, &c. be subdivided each into 4 or 60 parts, the radii produced through these from the centre to cut r s, will mark out quarters or even minutes.

Being thus enabled, by the help of these instruments, to lay down any series of angles with facility, it will not be difficult to describe the hour-*lines* on any dial, when we know the hour-*angles*. For if, for example, the hour-lines of I, II, III, &c. in the horizontal dial, Fig. 26. made with the hour-line of XII, the angles 12° 31′, 25° 34, 39° 39, &c. we have only to apply the protractor to the centre C, and to the hour-lines of XII, and lay off the above angles as already directed; or we may employ for the same purpose the line of chords. But in doing this we must be careful to allow a space, included within the parallel lines C A *c a*, and therefore to lay off the forenoon hours from the side C A and centre A, and those of the afternoon from the side c a, and centre *a*.

Meridian line.—We shall now therefore shew how the hour angles are to be determined in the various species of dials, and how each is to be fixed in its position; but as this last operation depends in all of them on a knowledge of the cardinal points, we shall first explain how to mark out a *meridian line.*

By the quadrant.—The quadrant or other instrument for measuring angles of elevation, is by far the most correct instrument for the purpose. Between the hours of 8 and 11 in the morning, observe at intervals, and always from the same spot, P, Fig. 32. several altitudes of the sun, and at each observation mark, by means of station staffs, A, B, C, the direction in which he then is, setting them up at about 100 yards off, and always at the same distance from the plane of observation. Watch the progress of the sun in the afternoon, and whenever he is observed, in descending, to have arrived at any of the altitudes which he was observed to have attained in the morning in ascending—mark his direction as before, by setting up another set of staffs *c, b, a.* Now the distances A *a*, B *b*, or C *c*, between the points of equal altitudes being each divided in two at the points 1, 2, 3, the line S 1 2 3, which joins the plane of observation with any or all of these points, will be in the meridian point. If a staff then be fixed at S in that line, it will always point due south from P; another at N in the same line will point due north; a third at W, so situated that W P is perpendicular to N S, will point to the west; and a fourth at E, in the line W P, will point to the east.

By shadows.—But if a quadrant be not at hand, the meridian line may be found in the same manner by the shadows of a pin projected on a board from which it rises perpendicularly; for, draw on the board P, Fig. 33. several concentric circles; mark in the forenoon when the shadow of the top of the pin formed by the sun falls on any of the circles, as at A, B, C; do the same in the afternoon at *a b c*; bisect A *a*, B *b*, C *c*, in the points 1, 2, 3; P 1, 2, 3, will be in the meridian,—and a staff may now be set up at some distance in that direction to mark the south.

Sect. II. *Of the Equinoctial Dial.*

The equinoctial dial, Fig. 20. is the simplest of all in its construction. When erected, its dial-plate is in the plane of the equator, the style is perpendicular to this, and the hour angles are all equal. To construct it, therefore, we have only from the centre p, with any radius p *a*, to describe a circle, divide it by means of the protractor or scale of chords into 24 equal parts, by the points 1, 2, 3, 4, &c; join these points of division with the centre, and produce them to meet the circumference in the hour lines, XII, I, II, III, &c. Fix a rod perpendicularly in the centre, projecting on both sides, and the dial is completed. In summer the sun will shine on the upper side of the dial, and on the under side in winter; it should therefore be graduated on both sides, but at the time of the equinox it will fail altogether, the style not projecting any shadow at all on either side,—though this defect might in some measure be remedied by raising a graduated rim on the under side.

Sect. III. *The Horizontal Dial.*

The horizontal dial, Fig. 26. differs from the equinoctial in having its dial-plate in the plane of the horizon. It differs from it also in the hour angles being unequal, and every different latitude requiring a different arrangement of them. But though thus more complicated in its construction, it is, when finished, much more convenient in practice, and of all dials indeed the most generally used. The style here is always elevated above the dial-plate as much as the plate is elevated above the horizon, that is to say, by an angle equal to the latitude of the place. It is also always in the meridian, and always coincides with the hour line of XII.

Hour angles.—The following table contains the hour angles, calculated with great exactness to every half degree of latitude, from that of 50° to 59½°; and thus the hour lines of a horizontal dial may be drawn with the greatest facility for any part of Great Britain.

A Table of the Angles which the Hour-lines form with the meridian on a horizontal dial, for every half degree of latitude, from 50° to 59° 30′.

Latitude.	A. M. I. XI.	A. M. II. X.	A. M. III. IX.	A. M. IV. VIII.	A. M. V. VII.	A. M. VI. VI.
50° 0′	11° 38′	23° 51′	37° 27′	53° 0′	70° 43′	90° 0′
50 30	11 41	24 1	37 40	53 11	70 51	90 0
51	11 46	24 10	37 51	53 24	70 58	90 0
51 30	11 51	24 19	38 4	53 36	71 6	90 0
52	11 55	24 27	38 14	53 46	71 13	90 0
52 30	12 0	24 36	38 25	53 58	71 20	90 0
53	12 5	24 45	38 37	54 8	71 27	90 0
53 30	12 9	24 54	38 48	54 19	71 34	90 0
54	12 14	25 2	38 58	54 29	71 40	90 0
54 30	12 18	25 10	39 9	54 39	71 47	90 0
55	12 23	25 19	39 19	54 49	71 53	90 0
55 30	12 28	25 27	39 29	54 59	71 59	90 0
56	12 32	25 35	39 40	55 8	72 5	90 0
56 30	12 36	25 45	39 50	55 18	72 12	90 0
57	12 40	25 51	39 59	55 27	72 17	90 0
57 30	12 44	25 58	40 9	55 37	72 22	90 0
58	12 48	26 5	40 18	55 45	72 27	90 0
58 30	12 52	26 13	40 27	55 54	72 33	90 0
59	12 56	26 20	40 36	56 2	72 39	90 0
59 30	13 0	26 27	40 45	56 10	72 44	90 0

In the latitude of 56°, for example, we find that the hour line of I on the one side, and of XI on the other, makes an angle at the centre of the dial of 12°32. The hour lines of II and X make an angle of 25° 19; III and IX, of 39° 19.; IV and VIII, of 55°8, and V and VII of 72° 5; the angle of VI and VI is invariable, and in every dial 90°; and the lines of V in the morning and VII in the evening are merely the continuation of those of V in the evening and VII in the morning, in the same manner as those of IV in the morning and VIII in the evening are the continuation of IV in the evening and VIII in the morning. The difference of latitude of half a degree will scarcely make a sensible difference in the hour angles; but if the latitude be not exactly found in the table, as, if it had been that of Edinburgh, 55° 58′, it is quite easy to make a small allowance; for the whole difference of 30′ in the latitude, between 55° 30′ and 56°, occasions only a difference of 4′ in the hour angle of I, and of 11′ in that of III. The error, therefore, that 2′ (by which 55° 58′ falls short of 56°) would occasion, is quite insensible; but 15′, the half of 30′, and the greatest difference that can occur, would require a correction of 5′, the half of 11′; and so on proportionally. Having thus found the hour angles, we have only to lay them off on the dial-plate, and the hour lines will thus be constructed. For any part of Great Britain, therefore, this method is the most expeditious, and the most accurate that can be proposed. But it may seem necessary to explain the more general methods by construction and calculation, which apply to any latitude whatever.

By the scale of chords and sines.—This method is very simple, but requires the use of a parallel ruler. Draw any two lines, A B, E D, Fig. 34. at right angles to each other. Let E D be the hour line of XII. Take the chord of 60° from the line of chords, lay it off from XII to C, in the line E D, and draw with this radius, and from C as a centre, the quadrant XII 6, and divide it into twelve equal parts, by laying off the chords of 15°, 30°, 45°, &c. from the line of chords, and from the point XII to 1, 2, 3, &c. Lastly, from the point XII, lay off XII *s*, equal to the sine of the latitude on the line of sines; draw now the parallel ruler over the points C and 1, and draw the occult line *s* I parallel to C I, and meeting A B in I. In the same manner, draw *s* II, *s* III, &c. parallel to C 2, C 3, &c.; join now C I, C II, C III, &c. and the angles XII C I, X C II, &c. will be the hour angles required of I, II, III, &c. which are the same with those of XI, X, IX, &c. These can be easily measured, by a protracter or otherwise, as they may be merely copied upon it from the paper on which the above drawing is made. In practice, the occult lines are drawn with the sharp point of a needle, or protracting pin.

By the dialling scales.—This method is also extremely simple and convenient, and has besides the advantage of applying to the dial-plate at once, without any previous construction. Draw any two lines, A O B, C O D, Fig 35. at right angles to each other, and crossing in O to represent the hour lines of XII and of VI. From the line of latitudes on the scale, take in the compasses the latitude of the place, and set it off from O, suppose to a, on the line A B. From the line of hours on the scale take the whole six hours, and setting one foot of the compasses in a, cut with the other the line O D, suppose in d; then taking each of the hours I, II, &c. from the line of hours in the scale, lay them off in succession from the point d towards a in the line d a, viz. d 1, d 2, d 3, &c.; join O 1, O 2, &c. and d O 1, d O 2, d O 3, &c. will be the hour angles of I, II, III, &c. Those of XI, X, &c. being exactly the same, may be copied from them, or another construction may be carried on at the same time with the first, on the opposite side; and the angles being thus obtained, they may be transferred, as before, to the dial-plate; or the whole operation which we have described may be performed on the dial-plate itself, and then the lines produced to the circumference of the dial, as at Fig. 26.

But in that case an allowance must be made for the breadth of the stile, and the forenoon hours laid off from the one side, and the afternoon from the other.

By the globe.—Elevate the pole to the latitude of the place; bring one of the meridians to the brazen meridian, and then look towards the wooden horizon, which here represents the plate of the dial. The brazen meridian actually cuts the horizon, and this point represents the hour of XII. The other meridians, each at the angular distance of 15° from the other, though they do not really cut the horizon, are observed to coincide with it at certain intervals. These points of coincidence mark the positions of the successive hours I, II, &c. on the east of the brazen meridian, and XI, X, &c. on the west, which, of course, are exactly alike. The wooden horizon, however, is divided into degrees, &c.; and by observing, therefore, at what degree these coincidences take place, we thus obtain the exact expressions of the hour angles, which can then be transferred, as before, to the dial-plate.

By calculation.—But the most exact method of finding the hour angles, is undoubtedly that by logarithmic calculation. This is easily done by the following rule. To the logarithmic sine of the latitude add successively the tangents of 15°, 30°, 45°, &c. and the sum, abating 10, the radius from each, will be the tangents of the hour angles of I, II, III, &c. The following is a table of these tangents:—

Degrees.	*Co-tangent.*	*Hours.*
15°	9. 42805	I and XI
30	9. 76144	II — X
45	10. 00000	III — IX
60	10. 23856	IV — VIII
75	10. 57194	V — VII
90	———	VI — VI

We have only, then, from a table of sines, to take the sine of the latitude and add to it the tangents in the above table, according to the hours in the next column. The distance between XII and VI is always 90°, whatever be the latitude. Thus, to make a horizontal dial for the latitude of Edinburgh, which is 55° 58′, take the sine of 55° 58′, viz. 9. 91840, and add to it successively the tangents, thus:—

9.91840 sine in lat. 55° 58′.
9,42805 tang. for I. and XI.
———
9.34645 tan. 12° 31.

9.91840
9.76144 tan. for II and X.
———
9.67984 tan. 25° 34.

9.91840
10. tan. for III and IX.
———
9.91840 tan. 39° 39.

9.91840
10.23856 tan. for IV. and VIII.
———
10.15696 tan. 55° 8.

9.91840
10.57194 tan. for V. and VII.
———
10.49034 tan. 72° 5.

Thus 12° 31, 25° 34, 39° 39, 55° 8, 72° 5, and 90°, are the respective hour angles of I, II, &c. for a horizontal dial at Edinburgh; and they are the same that have already appeared in the above table.

The style.—Having thus completed the dial-plate by any of the above methods, the next object is to attach the style. This is fixed to the dial-plate by screws or otherwise, and the edges for the shadow ought to be sharp and smooth; but the chief object of attention is the elevation which it is absolutely necessary to make exactly equal to the latitude of the place. Sometimes only a point of the style is used for casting a shadow, and this point is made the top, an upright pin, or the point of any ornamental object; but in all these cases the point must be situated in the line of the style,—the point must still be directed from the centre of the dial towards the pole, and the lines on the dial-plate must be long enough to receive the shadow of the point, whether it falls nearer the centre as the sun advances northward in his annual course, or recedes from it as he re-descends to the south—the shortness of the style being thus made up by the length of these lines.

Erection of the dial.—The last object, and not the least in importance, is to fix the dial in its intended place. Wherever this may be, these two conditions are necessary to make it go with exactness: 1*st*, the plane of the dial-plate must be horizontal, and, 2*dly*, the plane of the style must be in the meridian of the place, or must point towards the north and south. The first object is accomplished by a careful adjustment with a plummet or spirit-level, and the second by setting up a mark or signal-staff, at a considerable distance, towards the north and south: These cardinal points having been previously ascertained with exactness by the method already described, and then moving the dial until the mark is just observed on looking along the edge of the style, the whole instrument being then made fast, the business is completed.

Sect. IV. *Of Vertical or Erect Dials.*

Vertical dials are those of which the hour lines are drawn on a vertical plane. As there is but one horizontal plane, there is only one kind of horizontal dial. But as there is an infinite variety of vertical planes, namely, those which face the south, north, east, west, or any other point of the compass, so the different kinds of vertical dials, as we have already seen, are proportionally numerous.

A direct south dial.—The direct south dial is represented at Fig. 27. A. It is usually made square. The hour angles are exactly the same with those of a horizontal dial made for the *complement* of the latitude of the place; they are therefore found exactly in the same manner, and by either of the operations which we have already described for the horizontal dial, only substituting for the latitude its complement, and where the complement of the latitude occurs taking for it the latitude itself. The style also is formed exactly as in that of a horizontal dial, and fixed in the same manner exactly at the hour line of XII; but the angle by which it is elevated above the dial-plate is equal, not to the latitude, but to its complement. The forenoon and afternoon hours are also transposed from that of a horizontal dial; for as in the latter, when we look from the bottom to the top of the style, the forenoon hours are on the left, in the erect south dial they are on the right; and as the afternoon hours of the former are on the right, so here they are on the left. In setting the vertical dial, two conditions are necessary to make it work with accuracy; its dial-plate must be truly vertical or perpendicular to the horizon, and it must also point due east and west—the first is easily accomplished by means of the plummet, and the second by setting up a staff at some distance towards the east or west, as already directed. The instrument being then made fast, is completely finished. Instead of pointing upwards, however, as in the horizontal dial, the style will point downwards; instead of pointing towards the pole, it will point from it. As this dial can never be illuminated before six o'clock in the morning, or after six in the evening, it is unnecessary to draw on it more than twelve hours.

The vertical north dial.—The vertical north dial, Fig. 27. B, is nothing more than a vertical south dial for the same latitude, turned towards the north and inverted, with the forenoon and afternoon hours transposed—the former lying on the right, and the latter on the left, as we look from the bottom to the top of the style. It is only illuminated before six in the morning and after six in the evening, exactly as the light leaves the other. The two, therefore, might be united into one with a double face, and the same style projecting on each side, and this compound dial would be illuminated all the day.

Vertical east and west dials.—Fig. 28. represents a vertical east dial, which being turned to the west, its style elevated to the pole, and the forenoon hours changed to the afternoon, becomes a west dial. These dials are of the kind in which the hour lines, instead of converging to a point, are all parallel to each other. The style is rectangular and parallel to the dial-plate, as already described at Figs. 5. 6. and 7. The east dial tells the hours from sun-rise to mid-day; the west from mid-day to sun-set. If the style were much raised above the dial-plate in proportion to its length, the shadow would soon leave it altogether. To shew the hours from three in the morning to eleven, the dial must be at least five times the height of the style. The construction of the hour lines is extremely simple. It depends on the property of the hour-line of six being directly under the style. With a radius C XII, Fig. 34. equal to the height of the edge of the style above the dial-plate, describe an arc of a circle XII, VI.; draw the radius C XII, and the tangent A B at right angles to it, and divide the quadrant as already directed into six equal parts; from the centre C, draw radii to the points of division, and produce them to cut the line A B, which will then be divided according to the distances of the hour lines of the dial—the line C 1 marking the hour line of VII, C 2 that of VIII, and so on. To transfer these to the dial-plate, Fig. 28. draw near the top, parallel to the end, and separated from each other by the breadth of the style, the lines A a, B b, for the substyle and for the hour line of six. From A and a, towards XI and III, lay off the distance A VII, a VII,—A VIII, a VIII,—A IX, a IX, &c. equal to those found as above; and the same series B V, B IV, B III, &c. on the opposite side; join VI, VI,---VII, VII, &c. and the dial-plate is completed. Fix now the style perpendicularly over the hour line of VI, and adjust carefully its edge to the exact height by which the hour lines have been constructed, and the dial is ready for being erected. To go with accuracy, its plane must be set (by the method already described for the other dials,) in the meridian, or point due north and south; and its style on the hour lines, which are all parallel to it, must have an elevation equal to the latitude of the place, in order to point towards the pole. To effect this, draw across the dial-plate a line, III R, making the angle R P a equal to the latitude; then A P a will evidently point to the pole. When P R is horizontal, adjust P a, therefore, by the plummet or spirit level, and then fix the whole instrument in that position.

Polar dials.—Similar in construction to the vertical east and west, are the polar dials, represented at Fig. 29. The hour lines are all parallel; and they are constructed in the very same manner. These dials differ, however, in having the substylar line on the hour line of XII, which is therefore in the middle of the dial. They are also erected in quite a different position. They are made to slope towards the south, so that the dial-plate in the direction of its breadth may point towards the pole, and in the direction of its length may point due east and west. It may be set towards the pole, by attaching to it a base making an angle with the place of the dial equal to the latitude of the place, and fixing the base horizontally, the plane being adjusted at the same time east and west; in the manner already directed for the others.

Sect. V. *Declining and Reclining Dials.*

Of the dials which we have described, the simplest in their construction are the equinoctial, the polar, and the vertical east and west; and next to them are the horizontal, and the vertical north and south. Those which yet remain, namely, the vertical, the declining, the reclining, and the declining-reclining, as they are more irregular in their position, so it becomes somewhat a more complex operation to construct them. It is really, however, more an object of curiosity than of much utility, as there are very few cases in which the simpler dials will not be preferred. They differ from any of the others in the substyle line, except in recliners falling neither on the hour line of XII, nor on that of VI, but on some of the intermediate ones. The style itself also is not elevated above the dial-plate by an angle equal either to the latitude of the place, or its complement, but to some intermediate angle; and the true position of the style, therefore, on which alone depends the arrangement of the hour lines, becomes an object more difficult of computation. Both of them may be conveniently found by means of the globe.

Hour angles by the globe.—Elevate the pole to the latitude of the place, and, if it is a vertical *declining* dial, screw the quadrant of altitude on the zenith. Then, if the dial declines any number of degrees from the south towards the east, that is to say, if the plane of the dial-plate declines any number of degrees from the east towards the north, count the same number on the wooden horizon from the east point towards the north, and bring the lower end of the quadrant of altitude to that degree at which the reckoning ends, so that this quadrant may be in the same plane with that of the intended dial-plate; then bring any particular meridian to the brazen meridian; and the other meridians, each being at the distance of 15° from the other, will intersect the quadrant of altitude at certain intervals. The several degrees marked on the quadrant of altitude at which these coincidences take place, represent the hour angles from the hour line of XII, of the forenoon hours XI, X, IX, &c. For the afternoon hour angles, bring the quadrant of altitude to the same position in the west of the meridian, that is, count the degrees of declination from the west point of the horizon to the south, and bring the quadrant of altitude to the point where the reckoning ends, and the degrees on the quadrant as before, where it is met by the meridians, represent the afternoon hour angles. The number of hour angles thus read off on the quadrant shews the number of hours the sun will shine upon this dial. The angles being thus obtained, can easily be transferred to the dial-plate as already directed.

If the dial declines towards the west, that is, if its place declines any number of degrees towards the north, the quadrant of altitude, in order to read off the proper hour angles, must also be made to decline the same number of degrees to the north. But when we have obtained the hour angles for a dial declining any number of degrees to the east, the same will answer for a dial declining the same number west, if we only make the forenoon hours of the one those of the afternoon in the other. In finding the hour lines also of a south dial declining east, we find at the same time those of a north dial declining west; for a north-west dial is nothing more than a south-east one inverted, and turned to the north-west, the forenoon of hours of the one being made those of the afternoon in the other; so that in calculating the hour lines of a declining dial we obtain those of four declining dials at once, namely, of a dial declining the given number of degrees, first from the north towards the east, secondly from the south towards the west, thirdly from the north towards the east, and fourthly from the north towards the west.

If the dial *reclines*, that is, if it be neither vertical nor horizontal, but elevated any number of degrees with its plane, at the same time pointing due east and west, then the quadrant of altitude to read off the hour angles must be screwed, not at the zenith, but at the same number of degrees above the horizon that the plane of the dial is elevated, while its lower end must at the same time coincide with the east point of the horizon for the forenoon hours, and with the west point for those of the afternoon.

If the dial both reclines and declines, then, whatever number of degrees its plane rises above the horizon, the quadrant of altitude must be screwed so many degrees above the wooden horizon; and whatever number of degrees it at the same time declines towards the east or west, the quadrant must also be made to decline the same number; in short, whatever be the position of the plane of the dial-plate, the quadrant of altitude must have the same position in order to read off the hour lines.

Position of the style by the globe.—In horizontal and erect north and south dials, the position of the style is determined when we know its elevation, because we also know that it is directly above the hour line of XII; that a perpendicular to the dial-plate, from its extremity on any point of it, will always fall on this hour line; that the hour line of XII, in short, is the sub-style. But, in declining dials, it depends entirely on the declination on what hour-line the sub-style will fall. The position of the style, therefore, will not be determined by its elevation above, as there may be an infinite number of styles set round the same centre, and all having the same elevation. We must know also the hour line above which it stands,—the angle which the sub-style makes with the hour line of XII, which we shall call the angle of deviation. To find this angle by the globe, having placed the quadrant of altitude, as already directed, in the plane of the intended dial, bring the first meridian which is graduated up to the brazen meridian, then move it along the quadrant of altitude, and, observing on the equator the number of degrees which pass under the brazen meridian, move it until they amount to the number which expresses the declination of the dial; move it, that is to say, as far by these degrees as the quadrant itself has been moved along the wooden horizon. The quadrant and meridian will then be at right angles to each other; and the number of degrees cut off from the quadrant of altitude by the first meridian, the number intercepted between the first and the brazen meridian, will express the distance of the sub-style from the hour line of XII, the angle which the one makes with the other at the centre of the dial. But this operation gives us also the elevation of the style. For this is indicated by the number of degrees which the quadrant of altitude cuts from the first meridian, reckoning from the pole. Thus, for example,—required the position of the style of a dial in the latitude of Edinburgh, namely, 55° 58′, and declining 10° from the south towards the east. Elevate the pole 55° 58′; fix the quadrant of altitude in the zenith, and advance its lower extremity 10° on the wooden horizon from the east point towards the north; advance also the prime meridian from the brazen meridian 10° towards the east, counted on the equator. Then will the quadrant of altitude point out about 5° 40′ for the angle of the sub-style with the hour line of XII, while the prime meridian will, at the same time, mark about $33\frac{1}{2}$° for the style's elevation.

By computation.—The position of the style is obtained with greater accuracy by a simple calculation. To find the elevation of the style, add the logarithmic cosine of the declination to the cosine of the latitude, the sum is the sine of the style's elevation; or, to express it more briefly:

$$\text{Log. sine elev.} = \text{cos. decl.} + \text{cos. lat.}$$

Thus, in the above example, where lat. = 55° 58′, declin. = 10°, we have,

$$\begin{array}{l} 9.99335 \text{ cos. } 10^\circ \\ 9.74794 \text{ cos. } 55^\circ\ 58 \\ \hline \end{array}$$

Tang. elev. 9.74129 = sine elev.

But 9.74729 is the sine of 33° 27, which is therefore the elevation of the style as before. To find the distance of the sub-style from the hour line of XII, add the sine of the declination to the cotangent of the latitude,—the sum is the tangent of the distance required. Thus, in the above example, we have sine lat. = 9.91840, and adding,

Sin. 10°	9.25967
Cot. lat.	9.82953
	9.06920 = tang. 6° 41.

In *reclining* dials, the sub-style again coincides with the hour line of XII, and the elevation of the style is equal to the *sum* of the latitude and of the dial's elevation above the horizon, if it slopes towards the north, and to their difference if it slopes towards the south, the latitude, in both cases, being north; and, when the sum of the two angles exceeds 90°, the supplement of it being taken for the elevation. Thus, in a dial, latitude 55° 58, sloping to the south, and elevated above the horizon 30°, or, what is the same thing, reclining from the upright position 60°, the elevation of the style will be 25° 58, the difference between 30° and 55° 58; and sloping to the north, it would be 85° 58′. If it had been elevated 60° above the horizon, then sloping south, the style's elevation would be 4° 2′, and sloping north 64° 2′, that is the supplement of 115° 58′.

In declining-reclining dials, the calculation is a little more complex.

1*st*, Add the sine of the dial-plane's altitude above the horizon to the sine of its declination from the east or west; the sum is the cosine of an angle, which call A, that is, cos. A = sin. alt. + sin. dec.

2*d*, Add the tangent of the altitude to the cosine of the declination, the sum is the tangent of an angle, which call B, that is tang. B = tang. alt. + cos. dec.

3*d*, Take the difference between B and the latitude if the dial slopes south, and the supplement of the latitude if it slopes north; call this C, that is C = B — lat. or B — 180° lat.

4*th*, Add sine A to sine C, the sum is the sine of the style's elevation. Sin. elev. = sin. A + sin. C.

5*th*, Add cosine A to tangent C, the sum is the tangent of the style's deviation. Tang. dev. = cos. A + tang. C.

Example.—Those rules, though they seem complex, are easily applied, and as simple as the nature of the subject will admit. Example—To find the position of a dial in latitude $54\frac{1}{2}$°, sloping to the south, with an altitude of 75°, and declining west 25°.

Log. sin. alt. 75°		9.9849
Sin. dec. 25°		9.6.259
Cos. A = cos. 65° 55′ =		9.6108
Tang. 75°	—	10.5719
Cos. 25°	—	9.9573
Tang. B = tang. 73° 32′ =		10.5292

Hence, A = 65.55; B = 73.32.

C = B — lat. = 73.32 — 54.30 = 19.2

Sin. A 65.55	=	9.9604
Sin. C. 19.2	=	9.5134
Sin. elev. = sin. 17.20		9.4738

Cos. A	—	9.61073
Tang. C	—	9.53770
Tang. 8° 1′		9.14852

Hence, the style's elevation is 17° 20; and its deviation, the angle of the hour line of XII with the sub-style, is 8° 1.

Hour lines.—Having thus determined the position of the style, the next object is to draw the hour lines. This is done in a very simple manner by construction. Thus, to take the example of the declining dial, where we have found the style's elevation = 33.27, and its deviation 6° 41, with the chord of 60° describe a semicircle, A B D, Fig. 43. draw from the centre C, to represent the sub-style, the radius C B and the tangent E F at right angles from B; lay off the chord B XII of 6° 41, the deviation, so that C XII may be the hour line of XII; and, as in this case, the dial declines to the east, and the sub-style thus lies among the forenoon hours, lay off B 12 to the right. If the dial had declined westwards, the chord would have been laid off to the left. On B C lay off B S equal to the sine of the latitude parallel to XII S; draw C 12 from 12; on each side lay off the chords 12 1, 12 2, 12 3, &c. of 15° 30° 45°, &c.; draw S I parallel to C 1, S II parallel to C 2, S III parallel to C 3, and so on; join C I, C II, C III, &c.; then will C be the centre of the dial; and there the hour lines of I, II, &c. and the same process on the opposite side will give those of XI, X, &c. In the same manner is the declining-reclining dial constructed. The substyle falls here among the afternoon hours.

As the elevation of the style of a horizontal dial is equal to the latitude of the place, hence the above elevations also express the latitudes where the dials would be horizontal, while the angle B 12, Fig. 43. expresses their longitude; and thus the places themselves are determined.

Sect. VI. *Universal dials.*

Universal dials are those which answer for any latitude. In strictness, all dials are universal, as a horizontal or vertical dial will answer any latitude by becoming a declining or reclining one; but the hour lines must receive some modification, and therefore the term universal is only applied to those which can be easily adjusted to the latitude.

Equinoctial.—Such is the equinoctial dial represented at Fig. 42. It is merely a common equinoctial dial, A and D, fitted to a plate of wood or metal, C D E F, so as to open and shut upon a hinge C D, and having a graduated quadrant H, to regulate the degree of opening, and a compass, I, to set the instrument in the meridian. To use the dial, set the base C D E F on a horizontal plane; set the compass due south, allowing of course for the variation at present about 25° west, and elevate the dial-plate to an angle equal to the complement of the latitude of the place; that is to say, if the latitude were that of Edinburgh, 56°, move A B C D until it marks upon the quadrant H K, graduated from H, an angle of 34°.

Cross dial.—In the same manner may the polar and east and west dials become universal; and on this principle is constructed the dial on a cross, described by Mr Ferguson, and represented at Fig. 41. When rectified, the plane of the cross is in the plane of the equator, the arm *m k* points to the east, *n e* to the west, the plane of e k l f points to the pole, and on it is inscribed the polar dial *e k l f*; and on the east and west sides of the stem of the cross are drawn the E. and W. vertical dials, *b a n*. The cross is moveable in a graduated point C, and may thus be elevated to any latitude, the base A remaining horizontal, while the compass serves to fix it in the meridian. From III in the morning till VI, the upper edge *k l*, of the arm *i o*, will cast a shadow on the time of the day on the side of the arm *c m*; from VI to IX, the lower edge *i*, of the arm *i o*, will cast a shadow on the hours on the side *o q*; from IX in the morning to XII, the edge *a b*, of the top part *a n*, will cast a shadow on the hours on the arm *n c f*; from XII to III in the afternoon, the edge *c d* of the top part will cast a shadow on the hours on the arm k l m; from III to VI in the evening, the edge *g h* will cast a shadow on the hours on the part P g; and from VI till IX, the shadow of the edge *e f* will shew the time on the top part *a n*. The construction of the hour lines is obvious; but the breadth *k l*, or thickness of the cross, must be nearly one-half the length of the arms, in order that the shadow of *k l*, when the sun is at the tropic, and farthest from the equator, may not fall quite beyond the edge of the upright.

Sect. VII. *Compound Dials.*

Compound dials are those in which several are united together in one instrument, or in which other astronomical phenomena are shewn besides the mere hour of the day.

It is obvious, that the plane of a polar is perpendicular to the plane of an equinoctial dial, and that each of them is also perpendicular to the plane of a vertical east or west dial. Hence, all these dials may be united in the same machine, by taking a rectangular, or cubical block of wood, or stone, drawing on two of its opposite faces a vertical east and west dial, on two others an equinoctial, and on the third two a polar dial. If it be then set in the proper position, three of these dials will always go at the same time, and indicate the same hour.

In the same manner, if the cube be laid horizontally, and a horizontal dial be drawn on its upper face, vertical east and west dials upon the east and west faces, and vertical north and south dials on the others, three of these will always go together, and indicate the same hour. In the same manner may the surface of a solid body be formed into any number of faces, and dials being constructed on each of them a great number of them will shew the same hours together.

Each of these dials requires a separate style. But various ingenious combinations of a similar kind have been contrived, where one style regulates the whole. The construction of these will be understood by the inspection of Fig. 36., where I K is an equinoctial, A B C a horizontal, and E D C a vertical dial, F G being their common style.

One very curious property of these compound dials is that of pointing out the meridian. Since the dials on a horizontal cube only point out the same hour when the faces of the cube front the four cardinal points, it is clear, that if we do not already know these points, if we have not yet formed a meridian line, it would be easily obtained by shifting about a compound dial of this kind until the different dials should all indicate the same hour; the planes in the east and west dials would then be exactly in the plane of the meridian.

Fig. 40. represents a curious compound and universal dial. It consists of a thick piece of wood or metal, A B C D E F G H, Fig. 39. in which are cut four hemispherical hollows, A B, C D, E F, G H, and four intermediate angular hollows I K, L M, &c. in all which are inscribed the hour lines of so many dials, the styles of the former, *a b c d e f g h*, &c. projecting from the centre; an equinoctial dial is drawn in the middle on the top of the style of which, for its axis, is set a small terrestrial globe. The whole stands on a pillar in the middle of a round horizontal board, in which there is a compass for directing the meridian style to the south, and the pillar has a joint with a graduated quadrant for elevating the upright style to the latitude. The instrument being thus rectified, and the plane of the central dial parallel to the equator, its axis and that of the globe pointing to the pole, the same hour will thus be shewn in several of the hollows at once, by the ends of the shadows of their respective styles; all the places on the little globe, on which the sun shines, will correspond with those on the earth itself where it is then day; and the gradual advance of the line of light towards the west on this small scale will exactly represent the westerly advance of day over the great globe we ourselves inhabit, will shew the places where the sun is then rising, and those also on the other hand where he is setting, and the time of the day also by the hour lines on the equator. The hour lines in the hemispherical dials are all parallel to each other, and at equal distances; the hemispheres are all drawn to one radius, A a, assumed at pleasure, and this radius is made the distance, I k, L M, &c. between the points or styles, I, k, &c. of the angular dials. To draw the hour lines of these with the same radius L k, describe two axis I *t*, k *t*, cutting in *t*; divide I *t* and k *t*, each into four equal parts, join I 3, I, draw radii from the points of division, and produce them to meet the sides in the points 3, 4, 5, 6, 7, and 3, 2, 1, 12, 11; these are the points for the hour lines.

Card dial.—The portable dial on a card, represented at Fig. 37. is thus described by Mr Ferguson.

The lines *a d*, *a b*, and *b c* of the gnomon, must be cut quite through the card; and as the end *a b* of the gnomon is raised occasionally above the plane of the dial, it turns upon the uncut line *c d* as on a hinge. The dotted line *A B* must be slit quite through the card, and the thread *C* must be put through the slit, and have a knot tied behind, to keep it from being easily drawn out. On the other end of this thread is a small plummet *D*, and on the middle of it a small bead for showing the hour of the day.

To rectify this dial, set the thread in the slit right against the day of the month, and stretch the thread from the day of the month over the angular point where the curve lines meet at XII; then shift the bead to that point on the thread, and the dial will be rectified.

To find the hour of the day, raise the gnomon, (no matter how much or how little,) and hold the edge of the dial next the gnomon towards the sun, so as the uppermost edge of the shadow of the gnomon may just cover the *shadow-line*; and the bead then playing freely on the face of the dial by the weight of the plummet, will show the time of the day among the hour-lines, as it is forenoon or afternoon.

To find the time of sun-rising and setting, move the thread among the hour lines, until it either covers some one of them or lies parallel betwixt any two, and then it will cut the time of sun-rising among the forenoon hours, and of sun-setting among the afternoon hours for that day of the year to which the thread is set in the scale of months.

To find the sun's declination, stretch the thread from the day of the month over the angular point at XII, and it will cut the sun's declination as it is north or south for that day in the proper scale.

To find on what days the sun enters the signs—When the bead, as above rectified, moves along any of the curve lines which have the signs of the zodiac marked upon them, the sun enters those signs on the days pointed out by the thread in the scale of months.

The construction of this dial is very easy, especially if the reader compares it all along with Fig. 38. as he reads the following explanation of that figure.

Draw the occult line *A B* parallel to the top of the card, and cross it at right angles with the six o'clock line *E C D*; then upon C, as a centre, with the radius *C A* describe the semicircle *A E L*, and divide it into 12 equal parts, (beginning at A,) as *A r*, *A s*, &c. and from these points of division draw the hour-lines *r*, *s*, *t*, *u*, *v*, *E*, *w*, and *x*, all parallel to the six o'clock line *E C*. If each part of the semicircle be subdivided into four equal parts, they will give the half-hour lines and quarters as in Fig. 37. Draw the right line *A S D o*, making the angle *S A B* equal to the latitude of the place. Upon the centre *A* describe the arch *R S T*, and set off upon it the arcs *S R* and *S T*, each equal to $23\frac{1}{2}$ degrees for the sun's greatest declination, and divide them into $23\frac{1}{2}$ equal parts, as in Fig. 37. Through the intersection *D* of the lines *E C D*, and *A D o*, draw the right line *F D G* at right angles to *A D o*. Lay a ruler to the points *A* and *R*, and draw the line *A R F* through $23\frac{1}{2}$ degrees of south declination in the arc *S R*; and then laying the ruler to the points *A* and *T*, draw the line *A T G* through $23\frac{1}{2}$ degrees of north declination in the arc *S T*; so shall the lines *A R F* and *A T G* cut the line *F D G* in the proper lengths for the scale of months. Upon the centre *D*, with the radius *D F*, describe the semicircle *F o G*, which divide into six equal parts, *Fm*, *mn*, *no*, &c. and from these points of division draw the right lines *mh*, *ni*, *pk*, and *ql*, each parallel to *oD*. Then setting one foot of the compasses on the point *F*, extend the other to *A*, and describe the arc *A Z H* for the tropic of ♑; with the same extent, setting one foot in *G*, describe the arc *A E O* for the tropic of ♋. Next, setting one foot in the point *h*, and extending the other to *A*, describe the arc *A C I* for the beginnings of the signs ♒ and ♐; and with the same extent, setting one foot in the point *b*, describe the arc *A N* for the beginnings of the signs ♊ and ♌. Set one foot in the point *i*, and having extended the other to *A*, describe the arc *A K* for the beginnings of the signs ♓ and ♏; and, with the same extent, set one foot in *k*, and describe *A M* for the beginnings of the signs ♉ and ♍. Then, setting one foot in the point *D*, and extending the other to *A*, describe the curve *A L* for the beginnings of ♈ and ♎: This done, lay a ruler from the point *A* over the sun's declination in the arch *R S T*; and where the ruler cuts the line *F D G* make marks, and place the days of the months at these marks in the manner shown by Fig. 37. Lastly, draw the shadow-line *P Q* parallel to the occult line *A B*, make the gnomon, and set the hours to their respective lines, as in Fig. 37. and the dial is completed.

Sect. VIII. *Equation of Time.*

All these various dials indicate the time according to the sun; but the improvement of time-pieces soon shewed that the motion of the sun was not equal throughout the year. If a clock or watch, moving with the utmost uniformity, be compared from day to day with a dial, they will not keep always together; the dial will be observed at certain times of the year to be before the clock, at other times to be behind it, and sometimes again neither the one nor the other, but exactly to coincide with it. This will continue for a few days, when the dial will be observed, perhaps, before the clock; every succeeding day it will appear farther and farther from it than the preceding, until the difference amounts to 15 or 20 minutes. It will then cease to increase; in a short time it will begin to diminish, and at last will entirely disappear, and the dial and clock will be again together. In a few days, however, the dial will seem slow, will gradually fall behind as much as it had formerly been before, and after some time will again turn, again coincide with the clock, and again get the start of it. Such is the perpetual oscillation which the *true*, or *apparent* time, which is shewn by the sun, a dial performs round the *mean* time, as shewn by a well-regulated clock. But these variations have been found to be repeated pretty exactly from year to year. In the middle of April and of June, and in the end of August and December, the instruments are always nearly alike, and from these periods they diverge always in the same regular manner. It is obvious, therefore, that if we knew their amount for every day of the year,—if we knew every day how much the clock ought to be before the dial or behind it, we should then be able to tell, by looking at the dial, what ought to be the time upon the clock; and in this manner to correct it, if it has varied from the true standard. This difference between the clock and the dial, between mean and true time, is termed the *equation of time*. It is the quantity which must be added to or taken away from the true, or variable time, to *equate* it, or make it equal to the mean or uniform time. For this purpose, tables of the equation of time have been formed, shewing its amount for every day of the year; and a Table of this kind is often placed in the convenient form of a scale, on the face of the dial itself. The following table is calculated for every third day.

Equation of Time.

Days.	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sep.	Oct	Nov.	Dec.
1	4′ +	14′ +	13′ +	4′ +	3′ —	3′ —	3′ +	6′ +	0′ -	10′ -	16′ -	11′ -
3	5′	14′	12′	4′	3′	2′	4′	6,	1′	11′	16′	10′
5	6′	14′	12′	3′	3′	2	4′	6,	1′	11,	16′	9′
7	7′	15′	11′	2′	4′	2′	4′	5,	2′	12,	16′	8′
9	7′	15′	11′	2,	4′	1′	5′	5,	3′	13,	16′	8,
11	8′	15′	10,	1,	4′	1′	5′	5	3′	13,	16′	7′
13	9′	15,	10	1,	4′	1′	5′	5′	4,	14,	16′	6′
15	10′	15,	9′	0′	4′	0,	5′	4′	5′	14′	15′	5′
17	10′	14′	9′	0, —	4,	0′ +	6′	4′	5′	14′	15′	4′
19	11′	14,	8′	1′	4′	1′	6,	3′	6′	15	14′	3′
21	12′	14′	8′	1′	4,	1′	6′	3′	7,	15′	14,	2,
23	12′	14′	7′	2′	4′	2′	6′	3′	7,	15	13′	1,
25	13′	13′	6′	2′	4′	2′	6′	2′	8,	16′	13′	0, +
27	13′	13	6′	2′	3′	2,	6′	1′	9′	16′	12′	1,
29	13′		5′	3′	3′	3′	6′	1′	10′	16	12′	2,
31	14		4′		3′		6′	0′		16′		2′

Diamond.

DIAMOND, the hardest and most highly valued of precious stones, is entirely composed of carbone or pure charcoal, and from its peculiar action on light is remarkable for its brilliancy. See CHEMISTRY and GEOLOGY.

Diana.

DIANA, in ancient mythology, was the daughter of Jupiter and Latona, and the twin-sister of Apollo; had various attributes assigned to her, and was distinguished by different names, derived either from the places where she was worshipped, or the functions which she performed. On earth she is regarded as the goddess of the chace; in heaven she is represented as Luna, or the moon; and in the infernal regions as Proserpine, or Hecate, who presides over sorcery. Diana is represented as tall and handsome, with her feet bare, or adorned with buskins, and with a quiver on her shoulder, and a bow, or a javelin, in her right hand. Sometimes she appears with wings, holding a lion in one hand, and a panther in the other, with a chariot drawn by two heifers, or two horses of different colours; and sometimes she is represented with a quiver, and attended with dogs. Statues were generally erected to Diana in cross-ways; and hence she was called *Trivia;* and temples, the most celebrated of which was at Ephesus, were erected for her worship. The hunting-dress, the crescent on the head, and the dogs which attend her, are the usual symbolical appendages of Diana in pictures.

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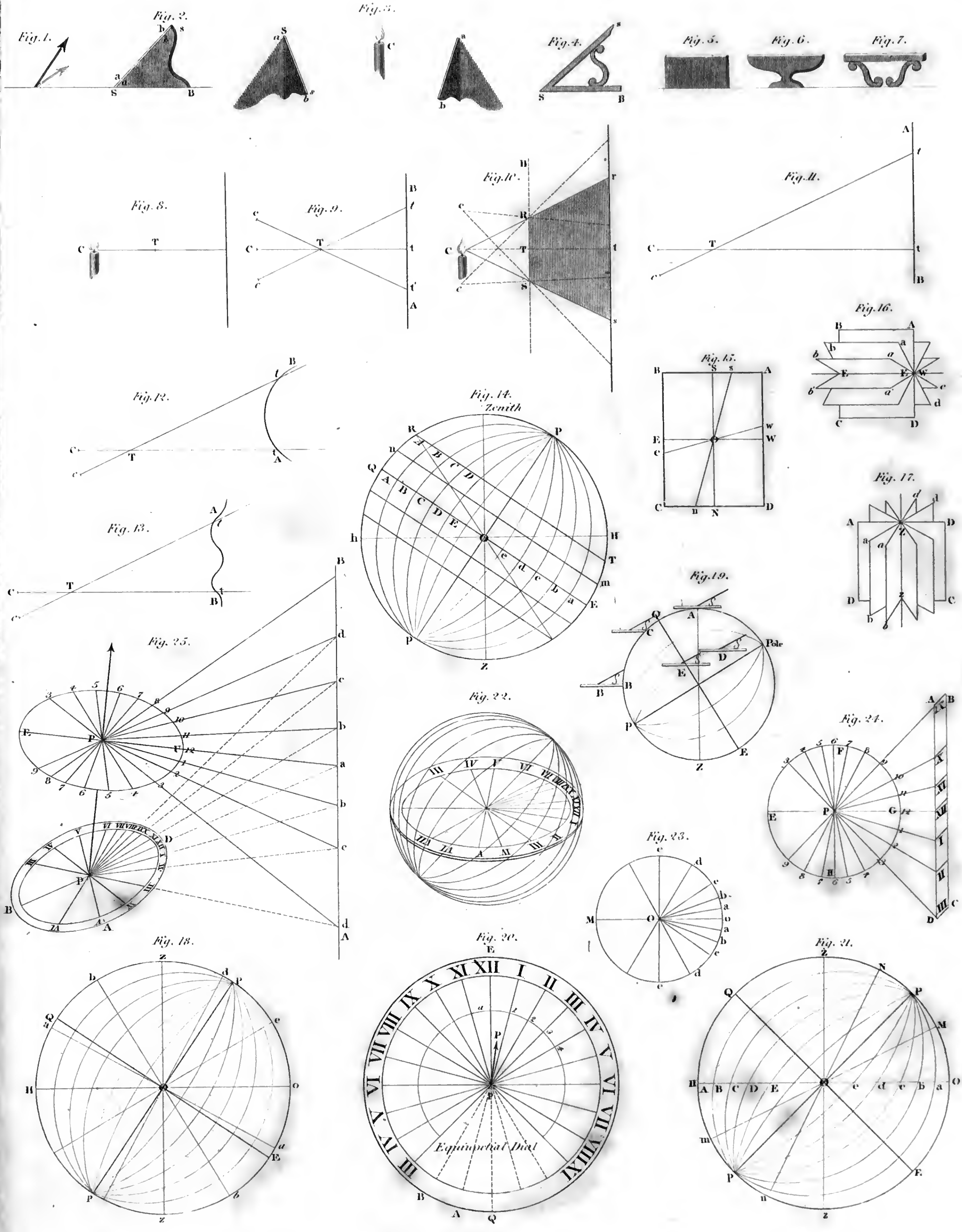

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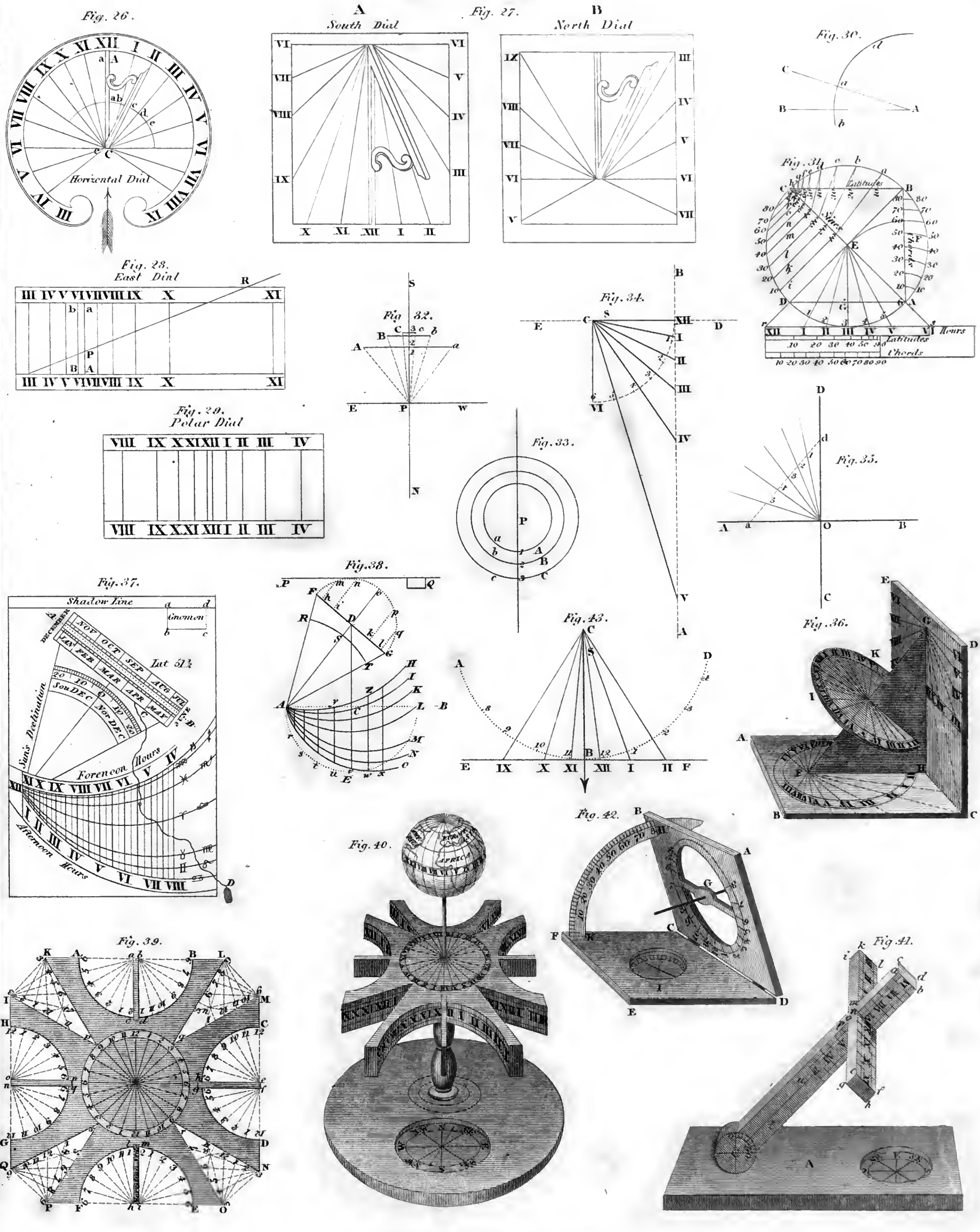

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